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**Impacts of Pedestrian Traffic on Urban Form:
A Case of Historic Core Area of Kathmandu**

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ABSTRACT

Pedestrian movement is one of the most environmentally friendly modes of transportation. Pedestrian activity helps to preserve the environment by limiting the usage of automobiles that pollute the air and noise. From an economic standpoint, increased pedestrian traffic in the streets means more possibility for increased business. Pedestrian transportation also promotes engagement and communication, as well as social equality and fairness. As land use changes, so does the dispersion of pedestrians. Over the past century, pedestrian access has declined steadily in most cities. With some exceptions, such as underground metro systems, each advance in transportation technology—from the horse-drawn streetcar to electric streetcar, on grade and elevated railways, automobile and superhighway, airplane and airport—has degraded the pedestrian environment. High-speed traffic broke up the fine-grained pedestrian network and imposed barriers to free movement on foot (Southworth,2008).

Cities in Kathmandu Valley were traditionally designed for walking and providing communal space for people to meet. Large numbers of people in Kathmandu Valley still walk for their daily mobility (MaYA,2013). The urban street and roads in Kathmandu Valley are not pedestrian-friendly in the absence of proper planning for pedestrians. Walking is the most pro-environment way of getting around, aside from biking. However, the increasing motor traffic in cities negatively affects the safety and environment of pedestrians. Pedestrians make up 15-20% of the deaths in road accidents in industrialized countries; this is 40-50% in developing countries. Other problems related to comfort and security also have to be considered to obtain a more pedestrian-friendly environment that promotes walking as a means of transport. Encouraging people to walk and use public transport can be a beneficial approach to tackle social and environmental issues associated with traffic and transportation. To motivate walking as a mode of choice of people, policymakers need to accord importance to pedestrians' needs and expectations.

This research focus on studying the impacts of pedestrian traffic on the urban form in historic core of Kathmandu. Kathmandu is rapidly urbanizing municipality where the pedestrian traffic has increased in even faster pace. To gain insight into the current

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scenario of study area, both qualitative and quantitative analytical methods were used using the data collected via interviews with key informants and questionnaire survey and pedestrian count at 8 different stations in the study area. Various elements with respect to urban form at study area were analyzed. The study has drawn conclusion and recommendations regarding the urban form and pedestrian traffic management for the municipality, and for the urban areas that are in stage of rapid urbanization.

The research on the relationship between pedestrian traffic and urban form would benefit the Ministry of Physical Infrastructure and Transport, Department of Transport, Kathmandu Metropolitan City, Urban Planners, Transport Planners, policy makers, decision-makers, and mostly the residents of Kathmandu Valley.

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1. CHAPTER I: INTRODUCTION

1.1. Background

Over the past century, pedestrian access has declined steadily in most cities. With some exceptions, such as underground metro systems, each advance in transportation technology—from horse-drawn streetcar to an electric streetcar, on grade and elevated railways, automobile and superhighway, airplane, and airport—has degraded the pedestrian environment. High-speed traffic broke up the fine-grained pedestrian network and imposed barriers to free movement on foot. In ignoring the pedestrian experience, the street lost its intimate scale and transparency and became a mere service road, devoid of public life. Modernist planning and design separated pedestrians from the automobile, shunting them off to raised plazas, skywalks, barren ‘greenways’, and sterile pedestrian malls. (Southworth, 2008)

Cities in Kathmandu Valley were traditionally designed for walking and providing communal space for people to meet. Large numbers of people in Kathmandu Valley still walk for their daily mobility. A recent study by the Ministry of Physical Infrastructure and Transport, and JICA showed that the travel mode share of walking is 40.7%. However, the share of walking has declined by more than 23% in the last two decades. This is mainly because the plans, policies, and infrastructure development that were adopted are almost exclusively vehicle-friendly, discouraging people to walk or cycle. Increasing motorization and vehicle-prioritized infrastructure have led to increased congestion, increased dependency on imported fossil fuel, high levels of air pollution, and a dramatic increase in road fatalities, especially among pedestrians and cyclists. (MaYA (Manav-kendrit Yatayat Abhiyan), 2013)

The lively and pedestrian-friendly streets of the Malla period and the unique streetscape of the Rana period, including streets in planned and haphazardly developed areas, are being rapidly transformed due to unmanaged urban growth, chaotic construction, and a growing number of vehicles in Kathmandu. This has destroyed the physical form, reduced social activities, increased accidents and decreased pedestrian comfort on all types of streets. These negative consequences cannot be addressed through the existing legal and institutional frameworks of the urban-development and traffic-management

authorities. Even recent street improvements have discouraged pedestrian movement, degraded the streetscape, and replaced public spaces with traffic. This has further congested pedestrians and traffic in areas that were already crowded. (Shrestha B. k., 2011)

1.2. Need of the research

Walking is the most pro-environment way of getting around, aside from biking! However, the increasing motor traffic in cities negatively affects the safety and environment of pedestrians. Pedestrians make up 15-20% of the deaths in road accidents in industrialized countries; this is 40-50% in developing countries. Other problems related to comfort and security also have to be considered to obtain a more pedestrian-friendly environment that promotes walking as a means of transport. Urban planning and land organization must be directed towards preserving and providing more foot space, and proximity of workplaces and services should be improved. Public spaces must be made livable with attractive and comfortable furniture, trees, devices for weather protection, benches, kiosks, etc. Multidisciplinary research is needed to refine and increase knowledge of the behavior of pedestrians, and to promote walking as a valuable way to enjoy city life and maintain health. To generate cities agreeable to pedestrians will be a great challenge in a program for developing sustainable cities. (Gakkai, 1995)

Encouraging people to walk and use public transport can be a beneficial approach to tackle social and environmental issues associated with traffic and transportation. To motivate walking as a mode of choice of people, policymakers need to accord importance to pedestrians' needs and expectations. Developing countries like India are lacking proper design guidelines for safer pedestrian infrastructure. With this background, it is essential to understand the concept of pedestrian needs for a safe and comfortable walking environment in Indian cities and provide a framework for planners to develop proper design guidelines for pedestrian infrastructures. (Bivina, 2019)

1.2. Importance of the research

The research on the relationship between pedestrian traffic and urban form would benefit the Ministry of Physical Infrastructure and Transport, Department of Transport, Kathmandu Metropolitan City, Urban Planners, Transport Planners, policy makers,

decision-makers, and mostly the residents of Kathmandu Valley. The research would help determine plans and policies that would encourage people to use NMT including walking as a travel choice that would be beneficial to the people of the city.

1.3. Problem statement

Main Problem: *The urban street and roads in Kathmandu Valley are not pedestrian-friendly in the absence of proper planning for pedestrians.*

A balanced provision of infrastructure starts with a balanced perception of what urban traffic is and should aim to achieve. The World Bank paper of 2006 on sustainable urban transport suggested that one of the reasons that it has been so difficult to achieve such balance is that many people automatically think of traffic as Motorized transport (MT) traffic and never realize that NMT traffic is there just as well,

The rapid increase in population and automobiles, and densification of the limited urban areas including the haphazard transformation of buildings have created conflicts between vehicular and pedestrian movement, increased traffic jams and road accidents, and increased air and noise pollution. The earlier form and function of the streets have also changed in many ways.

This city (Kathmandu) is growing day by day with higher expectations from people and nowadays people are feeling that the government bodies are not serious about their (pedestrians) safety. With the reference from past experiences and different media following are the major issues and problems faced by pedestrians in Kathmandu City;

- Footpaths are not available everywhere.
- Foot Paths are blocked with construction materials.
- Footpaths are filled with drains and muddy water.
- There are small shops on the footpaths.
- Vehicles do not give priority to walkers.
- Improper crossing areas.

Pedestrian traffic in Kathmandu Valley has increased significantly across all urban areas due to the pressures of urbanization. Kathmandu Metropolitan City is a rapidly

urbanizing municipality where pedestrian traffic has increased at an even faster pace. In absence of proper planning and regulatory policies, this overcrowding of pedestrian traffic has negative implications on the urban form of the KMC.

1.5. Research Question

Based on the Problem statement mention above, the created question can be formulated as following below:

- What are the impacts of pedestrian traffic on the urban form?

1.6. Research Objectives

The main objective of the research is to determine the impact of pedestrian traffic on elements of urban form.

The specific objectives are as follows:-

- To identify the factors related to pedestrian traffic affecting the urban form.
- To find the relationship between the built environment and pedestrian walking behavior.
- To evaluate the existing condition of pedestrian environment and related pedestrian problems.
- To recommend the outlines of pedestrian traffic management in the study area.

1.7. Limitations of Research

The limitations of research are as follows:-

- The study will be concerned with the physical aspect of the pedestrian environment. The socioeconomic aspect will not be focused on.
- Since it is difficult to quantify travelers' attitudes and values, the values and attitudes of the users have not been considered in this study.
- The study will be limited to the primary data collected from direct observation and also secondary data collected from various sources.

1.8. Expected outcomes

The expected outcomes of this thesis gives the theoretical and logical background to the necessity and improvement of pedestrian facilities for urban transport in the context of Kathmandu valley showing importance according to the hierarchy of road users and pedestrian users.

This research will help to find out quantifying and evaluating measures of pedestrian facilities in case of transportation sector of Kathmandu valley.

- Identification of problems and issues concerned with pedestrian environment.
- Identifies the measures for solving the problem of pedestrian planning in urban area.
- Generates recommendations to make urban area pedestrian friendly

2. CHAPTER II: LITERATURE REVIEW

2.1. Pedestrian

Pedestrians are persons moving by foot from place to place, or at a walking pace. (Doiron, 2005) A pedestrian is a person traveling on foot, whether walking or running. Also, some communities define those traveling using tiny wheels such as roller skates, skateboards as well as wheelchair users as pedestrians. It includes movement by physically challenged, visually impaired, old and very young for different purposes such as work, recreation, social interaction, shopping, etc, (Angwenyi, 2016)

People are more likely to walk rather than drive when there are pedestrian-friendly streets. A comfortable walking environment with sidewalks, weather protection, and attractive landscaping is a step toward encouraging people to take public transportation, ride their bikes, or walk instead of driving. This has social and health advantages in addition to environmental benefits since it encourages informal interactions among neighbors. (Pradhan, 2016)

Streets have served a variety of purposes. Outdoor activities in public areas may be divided into three categories: required activities, optional activities, and social activities. According to Jan Gehl, in higher quality public areas or streets, a wide range of optional activities such as taking a stroll to obtain some fresh air, greetings, discussions, and passive connections take place. (Pradhan, 2016)

Human body dimensions, locomotion, and behavioral preferences help to establish the requirements for accommodating pedestrians safely and conveniently. Human locomotion involves many complex skills of balance, timing (gait, perception, and reaction), and vision that are often taken for granted except by the physically impaired. Natural unimpeded walking requires a uniform, nonslip walking surface, and sufficient space both laterally and longitudinally to avoid conflicts with others. The width of the human body plus allowance for body sway determine lateral spacing, and individual pacing distance combined with perception and reaction times, the longitudinal spacing. Vision plays an important role in locomotion to perceive and react to variances in the walking surface and to avoid conflicts with others. (Kasula, 2016)

Minimum width of 2m is necessary for pedestrian walkways. But this width varies with the volume of pedestrians. Depending on the number of pedestrians passing, average walking speed, and accepted density per sq. meter, the required size can be calculated. For example: If 5000 people are passing per hour, and a density of 0.3 persons per sq. m. is accepted, the width of the pedestrian walkway has to be a minimum of 3.5 m. Densities are higher than 0.3 cause uncomfortable walking conditions. Densities of more than 1 person per sq. m. inhibit mobility. (Peterson, 2004)

2.2. Pedestrianization

Pedestrianization is defined as converting a street into an area for the use of pedestrians only by excluding all motor vehicles. Various definitions and meanings are available regarding pedestrianization. Hass-Klaus has defined pedestrianization simply as the removal of traffic from existing city streets except for emergency vehicles and controlled access to delivery vans and other transport, usually accompanied by suitable treatment in terms of paving, street furniture, and other design details. (Hass-Klau, 1993) North American cities like New York or Toronto, Canada have a broader sense of pedestrianization defining it as a concerted effort to make city streets walkable, i.e., designed for the safety and comfort of pedestrians. Some activists advocate large auto-free zones where pedestrians only or pedestrians and some non-motorized vehicles are allowed. (Mofrad, 2013)

Pedestrianization attempts to improve pedestrian accessibility and mobility, increase the amount of retail and other commercial activities in the region, and/or improve the visual appeal of the local environment in terms of aesthetics, air pollution, noise, and pedestrian accidents.

The pedestrian street can be seen from three points of view. It can be seen as a physical structure, a place of commercial activity, or a place of social interaction. Architects usually promote pedestrian streets from the physical viewpoint arguing for a better inner-city environment. Economists and shop owners look upon the pedestrian street from a commercial standpoint. Sociologists and often architects as well see the pedestrian street as a place where citizens meet and interact. An important aspect of the pedestrian street is that it is a social space where people meet. Many events are

organized there, people meet each other and simply “hang around”. How much of the latter two functions are prominent depends very much on the first one, i.e. the physical appearance. Some streets are more commercial, others are more social, and some are neither. However, all three aspects work together in shaping the mood and feeling of each pedestrian street. (Söderholm, 2008)

2.3. Definitions and Types of Pedestrian Street

There are different terms and different definitions for pedestrian streets in different countries for example car-free zones, pedestrian zones, auto-free zones, traffic-free zones, auto-restricted zones, pedestrian areas, pedestrian malls, and walkable streets. Some of the definitions are as follows:

The pedestrian mall is a street lined with storefronts and closed off to most automobile traffic. Emergency vehicles have access at all times and delivery vehicles are restricted to either limited delivery hours or entrances on the back streets.

Pedestrian mall means one or more streets or portions thereof, on which vehicular traffic is, or is to be, restricted in whole or in part and which is, or is to be, used exclusively or primarily for pedestrian travel.

Types of Pedestrian Street include the following:

1-Full time pedestrian streets:

In this design arrival of vehicles into the street is fully forbidden and usually, services are in the back of the street. In most cases, only emergency service vehicles are allowed to enter.

2- Part-time Pedestrian Streets:

Part-time pedestrian streets are those where vehicular access is allowed only in specific periods. There are no on-street parking spaces allowed but loading bays are available.

3- Traffic Calming Streets:

The third form of pedestrianization is traffic calming streets. They serve to reduce the dominance and speed of road vehicles. There are no restrictions to vehicle access, but footpaths are widened and parking spaces are reduced. Various traffic calming measures are used to slow down the speed of vehicles. They include speed tables, narrower traffic lanes, and the use of different road textures and colors to remind drivers that they are within traffic calming zones. (Iranmanesh, 2008)

2.4. Elements Governing Pedestrian-Friendly Environment

On-Street Parking: On-street parking facilities provide a buffer zone between the road and sidewalk. This helps in minimizing the speed of vehicles. On-street parking also provides access to people on the sidewalk directly from their vehicles. Recommended dimensions for on-street parallel parking is a minimum of 7'×22'.

Access Management: Pedestrians can be designed and managed by reducing conflict points, improving traffic flow, allowing more space for the use of pedestrians, and maintaining fewer travel lanes to cross at intersections.

Driveways: The main purpose of design driveways is to optimize pedestrian mobility, accessibility, and safety. Its guidelines are listed below.

- Space driveways at least 75 feet from intersections
- Pedestrian facility sidewalk shall be continuous across driveways. The level of the sidewalk should be maintained (2% max) and the driveway should be sloped so that driver goes up and over the sidewalk
- Driveways should be away from the intersections
- The number and width of driveways should be minimized.

Sidewalk Corridors: The sidewalk corridor includes all elements from the property line to the edge of the roadway including excessive pedestrian sidewalk or walkways, planting strips and furnishing zones, and frontage areas.

Street Corners: Street corners provide increased pedestrian space and opportunity for social interaction through the placement of benches and site furnishings as well as a safe refuge while waiting to cross the street. They also provide shorter crossing distances for pedestrians

Furniture and Utilities: Well-designed pedestrian environments are enhanced by urban design elements and street design furniture, such as benches, bus shelters, and water fountains. Urban streetscapes should be carefully designed to provide adequate space for furniture and utilities. Street furniture shall be consistent and coordinated in design, materials, colors, and styles that will be complementary to the architectural style. The placement and design of the elements should be coordinated to avoid visual clutter. These elements may include Lighting Fixtures, Waste Receptacles, Benches, Signage, and Bicycle Racks.

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Benches are important public resources that contribute to make the city an enjoyable space for pedestrians. The purpose of seating is for waiting and resting and areas along walkways provide welcome relief to pedestrians, and a place to sit together, interact and observe. Seating on street corners must not obstruct the driver's views. Benches are usually placed at bus stops. (Rehan, 2012)

Trash receptacles may be the most used streetscape element and should be conveniently located for pedestrian traffic near benches, bus stops, and other activity nodes. At a minimum, one trash receptacle should be placed at every corner. (Rehan, 2012)

Street Trees and Landscaping: Planting trees along the roadside have a positive impact on the pedestrian environment by softening and hardscape, providing shade and shelter. The selection of trees and shrubs should be in such a way that there should be a proper combination of big and small trees, shrubs with pleasant smell and height.

Street Lighting: The design criteria for general street lighting are:-

- The walking area should be well lit and have good sightlines
- Urban street lighting fixtures should typically be mounted at 25 to 40 feet (7.6 to 12.2 m)
- Cutoff luminaries should be provided to minimize glare and light pollution
- Street lights for motor vehicles lanes should generally be located in the edge zone or the median.
- Nearby landscape zone and recreational areas
- Light pole location needs to be coordinated in design to avoid conflict with other above and below grade utilities and street signing.
- Transition lighting should be provided along streets that lead from more intensely illuminated urban areas to outer, less developed areas.

Pedestrian Lighting: Lighting is an important element in the streetscape, as it should contribute to creating safe and aesthetically pleasing public spaces. All pedestrian areas should be lit at night, and lighting should be used to confirm the elements of landscaping, decoration, and important buildings

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The lighting of the street, including adjacent sidewalks, walkways, and bike lanes, increases the security of pedestrian safety and comfort. Its guidelines are as follows

- A new lighting system to replace or supplement the existing street lighting should incorporate light posts and fixtures that are pedestrian-friendly (shorter and more in scale with pedestrians, with less obstructive and harsh light sources)
- Pedestrian lighting fixtures shall be spaced closely and evenly
- Provide between 0.5 to 2.0 foot-candles of light along with the pedestrian travel ways, depending on condition.

Public art: Public art can make an invaluable contribution to local identity, and providing multiple and layered expressions. It can become a local landmark, or simply add richness to a building or landscape. Public art can tell complex stories about communities and their histories. These reinforce community identity and provide a basis for community pride and ownership. One of the ways to expand the opportunity for art is to take it beyond the decorative elements to the functional elements. Streetscape elements, such as light poles, manhole covers, sidewalks, tree grates, tree guards, and street furniture are all suitable elements for artistic expression. (Rehan, 2012)

Traffic Calming: Traffic calming refers to the slowdown of the motorized vehicle and making the motor users more aware of the potential of the pedestrians. Most traffic calming treatments (other than speed reduction) are typically not appropriate for the higher speed state highways and arterial streets. However, when the arterial becomes the main street of a town or a village center, some types of traffic calming devices may be appropriate (such as on-street parking, street trees, curb extension, or other treatments). Road width in residential areas should not exceed 3.5m, to prevent drivers from going too fast. (Peterson, 2004)

2.5. Principles for pedestrian facility design

Landscaping can add value to the aesthetics of the walking environment but it must be placed carefully since high shrubs and trees might also obscure from view (of drivers) the presence of vulnerable road users such as children (O'Flaherty, 1997; IHT, 1997).

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However, strategically located trees and greenery can be used instead of bollards to act as a marking for the entrance to the pedestrian area. Innovative design concepts can be used to hide roadside utilities from view to form a seating area for pedestrians (KonSULT).

The following design principles represent a set of ideals that should be incorporated, to some degree, into every pedestrian improvement. They are ordered roughly in terms of relative importance (Portland Transportation Office, 1998)

- i. The pedestrian system should be safe. Sidewalks, walkways, and crossings should be designed to minimize conflicts with motorized and non-motorized vehicle traffic, minimize tripping hazards and protruding objects, and promote a reality and perception of personal safety.
- ii. The pedestrian system should be accessible to all. Pedestrians of all ages and ability levels need to be able to safely and conveniently travel on foot or with a mobility device.
- iii. The pedestrian system should provide direct and convenient connections.
- iv. The pedestrian system should provide a comfortable place to walk.
- v. The pedestrian system should enhance the public realm of the city. The pedestrian system should be designed not only to serve a transportation function, but also to provide public spaces that enhance community, interaction, economic vitality, and the image of the city. Good design should enhance the look and feel of the pedestrian environment. The pedestrian environment includes open spaces such as plazas, courtyards, and squares, as well as the building facades that give shape to the space of the street. Amenities such as street furniture, banners, art, plantings, and special paving, along with historical elements and cultural references, should promote a sense of place.
- vi. Pedestrian improvements should be cost-effective and financially sustainable.
- vii. The pedestrian environment should be used for many things. The pedestrian environment should be a place where public activities are encouraged. Commercial activities such as dining, vending and advertising may be permitted when they do not interfere with safety and accessibility.

Pedestrian safety, accessibility, mobility, and comfort are enhanced by:

- Slower traffic speeds
- Fewer traffic lanes
- Narrower traffic lanes
- Shorter street crossing
- Clear visibility between pedestrian and vehicle at intersections
- A buffer from traffic provided by wider sidewalks, curbside bike lanes, and street parking
- Tighter corner radii
- Space in the sidewalk corridor for trees-planted boulevards, transit shelters, and other street furniture.

2.6. General Principles for Planning of Pedestrian

The planning of pedestrians refers to safety, security, continuity, convenience and comfort system coherence and attractiveness of pedestrian facility. The ultimate goal of pedestrian planning is to create a pedestrian-friendly environment to invite people to walk more, providing sufficient space for the people to be happy, to wander, to enjoy and finally to rest.

The goal of design for pedestrians is to improve the quality of the specific environment so that mobility, accessibility, safety, and health needs are fulfilled which is attractive for all pedestrians. Different principles are present which describe such approaches (Pandit, 2016)

- Design for All
- The 5 Cs
- Sustainable Safety Principles

Design for All: Design for all (D4A) is a principle aimed at satisfying the fundamental right of all human beings. Design for all is also known as universal design or inclusive design. This is the approach of Planning that is usable by a large group of people regardless of age, ability, or situation. This means that not only the site design but the complete route from door to door should be following D4A principles, as well as the distribution of essential destinations within the system.

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The 5Cs: To be functional for walking and sojourning, public space should comply with at least five requirements and they are as follows:

Convivial: It connects two qualities: “liveable” and “together”. Convivial public space means that its design and facilities support an agreeable sojourn, that it is liveable, enduring, and tolerable. Convivial public space feels safe and inviting for pedestrians, mainly because there are other human beings.

Convenience: It is related to the measure to which public space or a facility suits the pedestrians’ special needs, i.e. that it saves time or frustration. Convenience is a very subjective term and its meaning tends to change over time. What was once a convenience (a zebra crossing) is today regarded as a normal part of life. Likewise, today’s luxuries will probably be perceived in the same way in the future.

Connected: It refers to the property of the infrastructure network that links trip origins to desired destinations, thus making it possible for persons to get where they want to go, as well as the extent of linkages between different routes and networks.

Comfort: Comfortable means the extent to which walking is accommodated to competencies and abilities of all types of pedestrians. In objective functional terms, comfort refers to observable usability, where pedestrians can use spaces or facilities without the apparent need to strain one’s themselves. Comfort is primarily associated with positive feelings. It can, however, also be seen as no negative feelings. Therefore, facilities are usually seen as comfortable if one does not notice anything negative. In subjective terms, comfort is a state of mind, a feeling of usability without stress, uneasiness, or pain.

Conspicuous: It relates the measure to which an object or a facility is noticeable or eye-catching in terms of clear and legible routes, signing, and information.

Sustainable Safety Principles: Transportation corridors and facilities are major components of the nation’s landscape and public realm. Integrating comprehensive transportation planning with natural system analysis and land use planning is essential for creating liveable communities in sustainable environments.

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Functionality: It deals with the usability of public space for walking and waiting. Adequate space must be provided to the pedestrians for walking and waiting without any fear of traffic and other danger.

Homogeneity: Pedestrians should not be exposed to the path of heavy vehicles. In the intersection, the traffic speed should be limited so that both pedestrians and drivers get adequate time for the required reaction.

Predictability: Pedestrian walkways must be self-explaining so that they can guide clearly to the pedestrian for the pedestrian.

Awareness: Vehicle drivers and riders should be aware of the pedestrian traffic and pedestrians should be aware of the other road user and their rights. The pedestrian environment should be organized in such a way that both the group of people are exposed to a minimum risky situation.

2.7. Design Principle for Pedestrian Network Plan

Important principles for a pedestrian-friendly design include:-

Accessibility: Routes that lead directly and safely to the pedestrian infrastructure

Comfort and Attractiveness: Pavements should be designed attractive and comfortably. Sidewalks should be regularly checked if they are in proper condition, particularly concerning slippery or damaged surfaces and obstacles.

Lighting: Adequate lighting of pedestrian networks is a means for improving road safety as well as to imply a certain level of security against criminal attacks and for pedestrian comfort.

Access to other Modes of Transport: Pedestrian routes to the public transport stops need to be reachable and in a path network.

2.8. Objectives of Pedestrian Planning

The primary objectives of an improvement program for pedestrians are safety, security, convenience, continuity, comfort, system coherence, and attractiveness.

- **Pedestrian safety:** The first means to improve pedestrian safety is a reduction or elimination of pedestrian-vehicle conflicts by space separation, either horizontal or

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vertical, or by time separation. Horizontal separation can be accomplished by a pedestrian precinct, street, or mall, where vehicles are restricted or eliminated.

Vertical separation is attained through pedestrian underpasses or overpasses. There have been discouraging results where these were located off the normal and visible route of pedestrian trip desire lines, or where their use causes increased time and energy expenditures to climb stairs or even the perception of increased effort. Pedestrian curbs and grade separations cannot be considered as sufficient safety improvements in and of themselves but must be incorporated into a larger pedestrian network.

Engineering for pedestrian safety involves the provision of physical improvements to reduce pedestrian accident exposure. This would include standardization of signs and signals, distinctive crosswalk delineation particularly aimed at driver recognition of crosswalk zones, improving motorist lines of sight, upgraded street lighting, and any other

physical features that contribute to pedestrian safety.

- **Pedestrian security:** Building and street configurations should be arranged to enhance clear observation by other pedestrians and policing personnel. High lighting levels, unobstructed lines of sight, and avoidance of building or landscaping configurations that provide concealment will assist in this objective. Television surveillance is increasingly used in buildings, transit stations, and major street locations.

Street lighting is an important aspect of pedestrian security, safety, and favorable perception of the urban image. In addition to its safety and security value, lighting can be used to improve the pedestrian's perception of urban space. Building facades, fountains, and other attractive natural or architectural features may be floodlit to improve their appearance at night. Colored lighting can provide added visual variety.

- **Pedestrian convenience:** Sidewalk obstructions, such as mailboxes, telephone booths, newsstands, refuse cans, and planters, can be relocated to improve pedestrian flow at practically no cost. Other more stationary items, such as traffic light standards, fire hydrants, and fire alarm boxes, could be moved under normal replacement schedules.

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Ramped curb cuts provide convenience for handicapped pedestrians in wheelchairs, persons wheeling baby carriages, and for others who have difficulties with high curbs. Tactile trails for the blind can be installed in and around buildings and urban places that are frequented by the visually impaired.

- **Continuity:** The importance of system continuity cannot be overemphasized. That is, the pedestrian improvements must be direct, accessible, and in the common pedestrian pathway of “perceived least effort.” Developers of Chase Manhattan Plaza, in the downtown financial district of Manhattan, have built well-designed pedestrian-oriented building service facilities, consisting of an elevated, attractively landscaped plaza, and generous belowground connections to the subway. This development serves, with great efficiency, the two large office buildings abutting the plaza. However, the plaza is an island without linkages to other buildings or transit stations in the area. The complex, therefore, provides little contribution to the system-wide deficiencies that exist in this crowded district.

- **System coherence:** Visual and functional coherence is a necessary element of the pedestrian design if the full utility of the space is to be realized. All elements of the urban core, including street systems, transit facilities, office buildings, civic centers, and theater complexes, and shopping areas, should have clear visual statements that convey their direction, function, and purpose. When pedestrians can satisfy their need for orientation and direction, their alertness of sensory gradients and changes in color, light, ground slope, smells, sound, and textures is increased.

System coherence is also an important element of building design, particularly for transportation terminals. An incoherent passenger terminal configuration multiplies the number of directional signs, thus decreasing individual sight effectiveness. Signs should be considered as a supplementary message to confirm the visual statements expressed

by the legibility of the building design itself.

- **Attractiveness:** Landscaping, pavement color and texture, well-designed street furniture, fountains, and plazas increase the visual variety of the cityscape. Opportunities for introducing elements of surprise, through suddenly revealed vistas and panoramic views, should not be overlooked.

Aesthetic improvements may also involve the restoration of buildings with distinctive architectural features or historical significance, additions of landscaping, creating small parks or plazas on unused lots, variations in sidewalk pavement colors and textures, variations in lighting, and cultural innovations such as downtown art exhibits or concerts.

2.9. Factors that Influence Choice of Travel Mode

Many factors influence the choice of travel mode and, specifically, the decision to walk. The National Bicycling and Walking Study (FHWA 1992) showed that there is a three-tiered hierarchy of factors:

1. **Initial considerations.** Many people rely on their automobiles to go virtually anywhere and never seriously consider the option of walking. An individual's attitudes and values also play a role—e.g., walking may be considered as “not cool.” Perceptions are also important in the decision to walk—e.g., safety concerns about traveling at night. Finally, there are situational constraints that, if they do not preclude the decision to walk, do require additional planning and effort. Examples include needing a car at work or having to pick up children from soccer practice.

2. **Trip barriers.** Concern for safety in traffic is a frequently cited reason for not walking.

This is particularly true where there are no alternatives to walking along high-speed, high-volume roadways. There may be problems with access and linkage, e.g., lack of connections between neighborhoods and shopping areas or parks. Environmental factors such as rugged topography or extremes in weather can also be considered as barriers.

3. **Destination barriers.** Lack of support from employers or coworkers can act as a barrier, e.g., relaxing the dress code or establishing a policy of flextime.

2.10. Pedestrian Traffic:

Pedestrian traffic refers to people walking along the street, through town, and so on. A pedestrian crossing, often known as a crosswalk, is a defined area where people can cross a road. Crosswalks are intended to keep pedestrians together in areas where they may be seen by cars and cross safely across automobile traffic. (Pandit S. S., 2016)

Pedestrian traffic volumes and queuing relationships can be defined based on average pedestrian area occupancy. The pedestrian traffic volume provides the necessary measures for design. It presents the analysis and principles used to develop a rational pedestrian-oriented plan.

i. Flow Volume

It is the number of traffic units passing a point in a unit of time. In pedestrian design, flow is expressed as pedestrians per unit of width (in feet) of the walkway or stairway per minute, or Pedestrians/Foot/Minute (PFM). Flow is the most important traffic characteristic because it determines the width of the pedestrian way (pedway). An inadequate width restricts flow, resulting in pedestrian inconvenience. Volume has been designated as P.

ii. Speed

Pedestrian locomotion speed, expressed in distance per unit of time, generally in feet per minute. When related to the design of a pedway section, speed is the average speed of all pedestrians passing through the section during the design interval. Speed is designated as S.

iii. Density

The number of traffic units per unit of area. In pedestrian design, density would be expressed in tenths of a pedestrian per square foot, a difficult unit to visualize. A more manageable unit, the reciprocal of density, or the sq. ft. of area per pedestrian, is used consistently in this article. The reciprocal of density has been designated as M, the Pedestrian Area Module.

iv. Headway

The time and distance separation between traffic units (pedestrians, in the context of this article). For example, a two-second headway is the equivalent of one unit (pedestrian) passing a point every two seconds, or a flow volume of 30 traffic units per minute. Headway has not been commonly referred to in the design of pedestrian facilities, but it has useful applications.

v. **Queue**

Is defined as one or more traffic units and in this discussion pedestrians who are waiting for service. If the pedestrian areas or service facilities have insufficient capacity, a pedestrian queue will develop. Queue lengths and duration will vary according to traffic flow characteristics. In crowded systems, queues may be generated intermittently, due to random variations in traffic intensity.

The flow equation, the classic relationship of traffic design, derived from an analogy to fluid flow in channels, is expressed as follows:

$$\text{Flow Volume} = \text{Average Speed} \times \text{Average Density}$$

or, $P = S \times D$

2.11. Principles of Pedestrian Flow:

The qualitative measures of pedestrian flow are similar to those used for vehicular flow, such as the freedom to choose desired speeds and to bypass others. However, there are specific pedestrian characteristics like the ability to cross a pedestrian traffic stream, to walk in the reverse direction of major pedestrian flow, to maneuver without conflicts and changes in walking speed, and delay experienced by pedestrians at signalized and unsignalized intersections. (HCM,2000)

The environmental factors which impact pedestrian traffic are comfort, convenience, safety, security, and economy of the walkway system.

Comfort factors include weather protection, climate control, shelters, and other pedestrian amenities.

Convenience factors include walking distance, pathway directness, grades, sidewalk ramps, directional signing, directory maps, and other features making pedestrians easy and uncomplicated.

2.12. Pedestrian Space Requirements

A simplified body ellipse of 1.5ft x 2ft with a total area of 3ft², is used as basic space for a single pedestrian. This represents a practical minimum for standing for pedestrians. In the evaluation pedestrian facility, an area of 8 ft² is used as the buffer zone for each pedestrian.

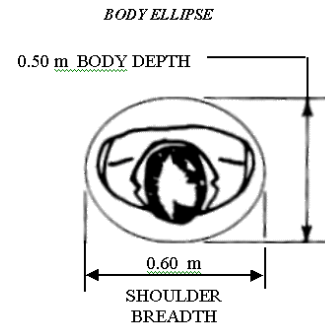


FIGURE 1: RECOMMENDED BODY ELLIPSE
FOR STANDING AREA (HCM,2000)

2.13. Pedestrian Walking speed

This is highly dependent on the proportion of elderly pedestrians in the walking population. J. Fruin (1987) contends that if up to 20% of pedestrians are elderly, the average walking speed is 4 ft/s on walkways. If elderly people constitute more than 20% of total pedestrians, the average walking speed decreases to 3 ft/s. In addition a walkway upgrade of 10% or more reduces walking speed by 0.5 ft/s. On the free flow speed of pedestrians is approximately 5ft/s there are several other conditions that could reduce average pedestrian speed, such as high percentage of slow walking children in the pedestrian flow.

2.14. Effective Walkway Width

The concept of a pedestrian lane has been used to analyze pedestrian flow, similar to analyzing a highway lane. HCM (2000) asserts that to avoid interference when two pedestrian pass each other, each should have at least 2.5 ft of walkway width. When pedestrians who know each other walk close together, each occupies a width of 2 ft, 2 inch, allowing considerable likelihood of contact due to body sway. Clear walkway width refers to the portion of a walkway that can be used efficiently for pedestrian movements. Moving pedestrians shy away from the curb and do not press closely against building walls.

2.15. Pedestrian type and trip purpose

The analysis of pedestrian flow generally is based on the mean or average walking speed of group of pedestrians. Within any group there can be considerable differences

in flow characteristics due to trip purpose, land use, type of group, age and other factors. (Giri, 2010)

Pedestrians going to and from work, using the same facilities day after day walk at higher speed than shoppers.

Studies have shown that older or very young people tend to walk at a slower speed than other groups. Shoppers not only tend to walk slower than commuter, but also can decrease the effective walkway width by stopping to window shop and by carrying packages. The analyst should adjust for pedestrian behavior that deviates from the regular patterns represented in the basic speed, volume, and density curves.

2.16. Pedestrian Walking Distances

Walking distances are important because they are a factor in plan configuration and a measure of design serviceability. Tolerable distances are a subjective human variable. Based upon pedestrian studies at Port of New York Authority bus terminals, the practical limit of human walking distance appears to be related more to the context and situation than human energy. For most persons, the maximum tolerable walk distance is in the range of a normal 5-to-7 minute walk. The anxiety connected with meeting schedules, making the trip, and negotiating an unfamiliar building, however, tend to make these distances appear to be much longer. The tolerable walking distance for a given design situation is related to such factors like the trip purpose of the individual, available time, and the walking environment, rather than energy consumption. This suggests that improvement of the design environment to reduce negative psychological factors is as important as reducing pedestrian walking distances.

2.17. Quantifying measures of the pedestrian facility (Level of Service):

The Level of Service Concept was first developed in the field of traffic engineering in recognition of the fact that capacity design was, in effect, resulting in planned congestion. The Level of Service concept provides a useful standard for the design of pedestrian spaces as well. Pedestrian service standards should, similarly, be based on the freedom to select normal locomotion speed, the ability to bypass slow-moving

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pedestrians, and the relative ease of cross- and reverse-flow movements at traffic concentrations.

Level of Service standards is not a substitute for judgment. The designer must examine all elements of pedway design, including such traffic characteristics as the magnitude and duration of peaks, surging or platooning caused by traffic-light cycles or transit arrivals, and the economic ramifications of space utilization.

The Level of Service standards detailed below is based on a range of pedestrian area occupancies. Design volumes for walkways and stairways are presented as a range. Walkway and stairway Levels of Service are illustrated by drawings of one-directional flow at the approximate pedestrian area occupancy representing that service level. The drawings are supplemented by a written description of the qualitative aspects of each Level of Service.

Walkways: Level of Service A

Average Pedestrian Area Occupancy: 35 sq. ft. (3.25 m sq.) per person, or greater.

Average Flow Volume: 7 PFM (Pedestrian Foot per Minute), or less.

At Walkway Level of Service A, a sufficient area is provided for pedestrians to freely select their walking speed, bypass slower pedestrians, and avoid crossing conflicts with others. Designs consistent with this Level of Service would include public buildings or plazas without severe peaking characteristics or space restrictions.



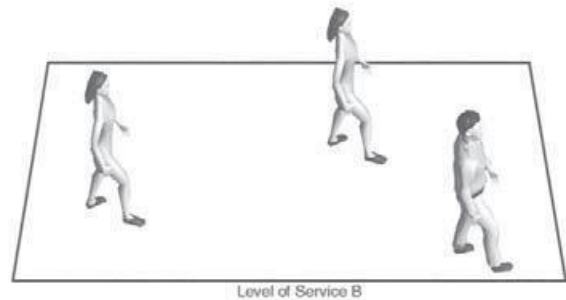
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Walkways: Level of Service B

Average Pedestrian Area Occupancy: 25–35 sq. ft. (2.3–3.25 m sq.) per person.

Average Flow Volume: 7–10 PFM.

At Walkway Level of Service B, sufficient space is available to select a normal walking speed and to bypass other pedestrians in primarily one-directional flows. Where reverse directions or pedestrian crossing movements exist, minor conflicts will occur, slightly lowering mean pedestrian speeds and potential volumes.

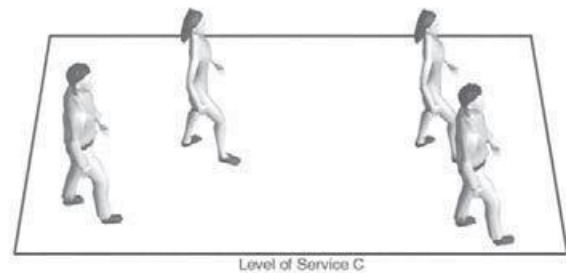


Walkways: Level of Service C

Average Pedestrian Area Occupancy: 15–25 sq. ft. (1.4–2.3 m sq.) per person.

Average Flow Volume: 10–15 PFM.

At Walkway Level of Service C, the freedom to select the individual walking speed and freely pass other pedestrians is restricted. Where pedestrian cross movements and reverse flows exist, there is a high probability of conflict requiring frequent adjustment of speed and direction to avoid contact.

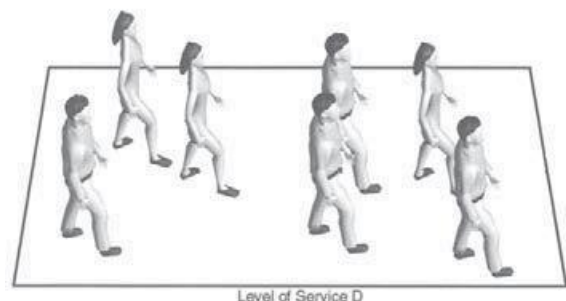


Walkways: Level of Service D

Average Pedestrian Area Occupancy: 10–15 sq. ft. (1 m–1.4 m sq.) per person.

Average Flow Volume: 15–20 PFM,

At Walkway Level of Service D, the majority of persons would have their normal walking speeds restricted and reduced, due to difficulties in bypassing slower-moving pedestrians and avoiding conflicts. Pedestrians involved in reverse flow and



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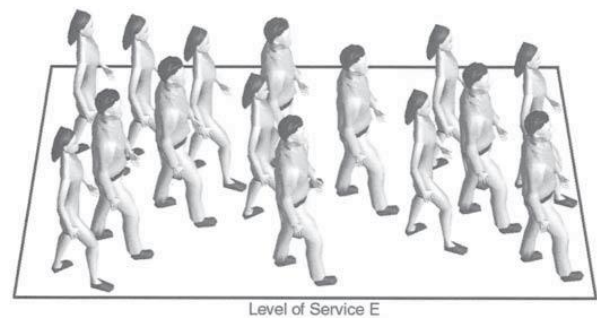
crossing movements would be severally restricted, with the occurrence of multiple conflicts with others. Designs at this Level of Service would be representative of the most crowded public areas, where it is necessary to alter walking stride and direction continually to maintain reasonable forward progress. At this Level of Service, there is some probability of intermittently reaching critical density, causing momentary stoppages of flow. Designs consistent with this Level of Service would represent only the most crowded public areas.

Walkways: Level of Service E

Average Pedestrian Area Occupancy: 5–10 sq. ft. (.46–1 m sq.) per person.

Average flow Volume: 20–25 PFM.

At Walkway Level of Service E, virtually all pedestrians would have their normal



walking speeds restricted, requiring frequent adjustments of gait. At the lower end of the range, forward progress would only be made by shuffling. Insufficient areas would be available to bypass slower-moving pedestrians. Extreme difficulties would be experienced by pedestrians attempting reverse flow and cross-flow movements. The design volume approaches the maximum attainable capacity of the walkway, with resulting frequent stoppages and interruptions of flow. This design range should only be acceptable for short peaks in the most crowded areas. This design level would occur naturally with bulk arrival traffic patterns that immediately exceed available capacity, and this is the only design situation for which it would be recommended.

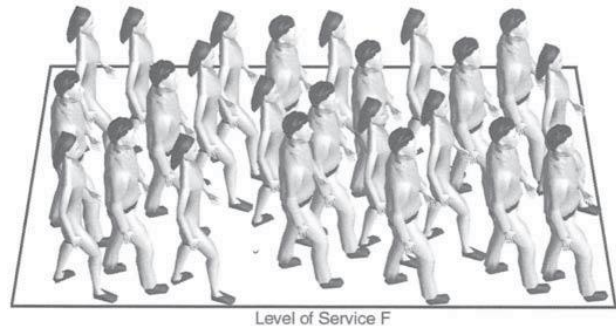
Examples would include sports stadium design or rail transit facilities where there may be a large but short-term existing of passengers from a train. When this Level of Service is assumed for these design conditions, the limited adequacy of pedestrian holding areas at critical design sections, and all supplementary pedestrian facilities, must be carefully evaluated for amenity and safety.

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Walkways: Level of Service F

Average Pedestrian Area Occupancy: 5 sq. ft. (.46 m sq.) per person or less.

Average flow Volume: Variable, up to 25 PFM.



At Walkway Level of Service F, all pedestrian walking speeds are extremely restricted. Forward progress can only be made by shuffling. There would be frequent, unavoidable contact with other pedestrians, and reverse or crossing movements would be virtually impossible. Traffic flow would be sporadic, with forwarding progress based on the movement of those in front. This Level of Service is representative of a loss of control and a complete breakdown in traffic flow. Pedestrian areas below 5 sq. ft. are more representative of queuing, rather than a traffic flow situation. This Level of Service is not recommended for walkway design.

2.18. Walkway width requirements:

Total walkway width is the sum of two components

1. Effective width (EWW) – portion of the walkway actually available for pedestrian travel, free from any physical obstruction
2. Ancillary width (AWW) - portion of walkway occupied by obstruction (window shopping, street furniture)

EWW is a function of :-

- No. of pedestrian passing a fixed point on the walkway per unit time (demand Volume in pedestrian per minute)
- The average pedestrian walking speed along walkway component

The average pedestrian space area, expressed as sq. ft per pedestrian

$$\text{Effective walkway width in ft.} = \frac{V(\text{Peds/min}) \times M(\text{sft/ped})}{S(\text{ft/min})}$$

Where,

V=Demand volume in ped per min

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M=Specified space area in sft per pedestrian

S=Walking speed in feet per minute

2.19. Pedestrian Zone

A pedestrian zone is simply an area where vehicles are restricted and reserved for pedestrians who are free to occupy the entire space. The zone entrances and exits are often designated with signage to make all users of the road aware when they are entering or exiting such an area.

As pointed out by Rubenstein (1992); three types of pedestrian malls have commonly been implemented in the United States. The first type consists of a traditional pedestrian street designed for exclusive pedestrian use (Full mall) (Figure2). The second type is the shared mall that permits limited automobile use such as one lane of one-way traffic (Semi mall) (Figure3). The third type is the transit mall which accommodates both pedestrian and transit use (Figure 4).



FIGURE 2: PEDESTRIAN ZONES (BUDAPEST, HUNGARY)

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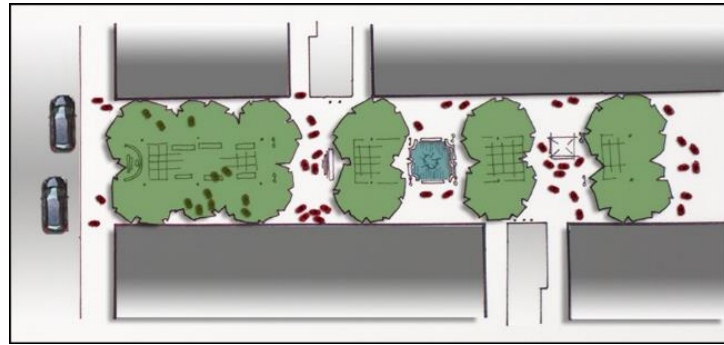


FIGURE 3: FULL MALL

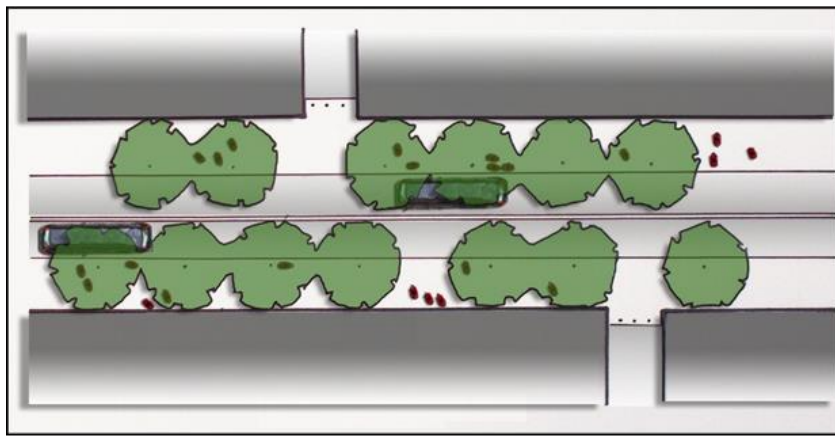


FIGURE 4: TRANSIT MALL

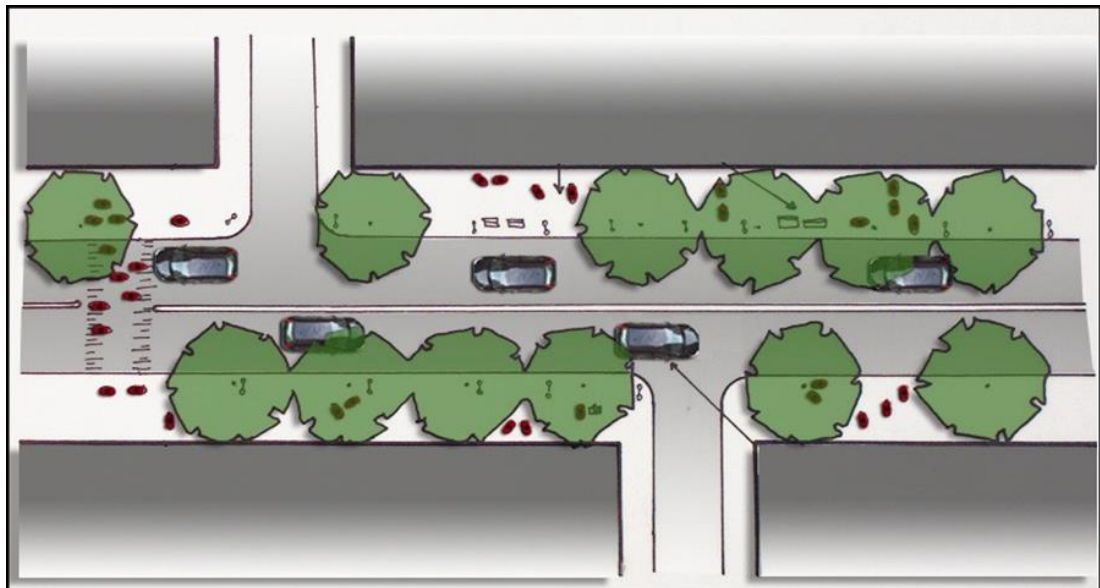


FIGURE 5: SEMI-MALL

Research shows that pedestrian zones have some characteristics (Melia et al, 2010; Ornetzeder et al, 2008).

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Characteristics to the development of pedestrian zones were:

- high rates of walking and cycling.
- more independent movement and active play amongst children
- less land taken for parking and roads - more available green or social space
- very low levels of car use, resulting in much less traffic on surrounding roads

The main benefits found for pedestrian zone developments:

- Low atmospheric emissions.
- Low road accident rates.
- Better built environment conditions.
- Discouragement of private cars and other motorized vehicles (a measure of travel demand management).
- Encouragement of active modes.

The main problem of pedestrian zones is related to parking management. Where parking is not controlled in the surrounding area, this often results in complaints from neighbors about overspill parking.

2.20. The Footpath Zones

Comfort, continuity, and safety are the governing criteria for the design and construction of pedestrian facilities. For this reason, the footpaths are divided into three main zones: the frontage zone (also known as “dead width”), the pedestrian zone, and the furniture zone. Each of these zones plays an important role in a well-functioning footpath. (Jani, 2013)

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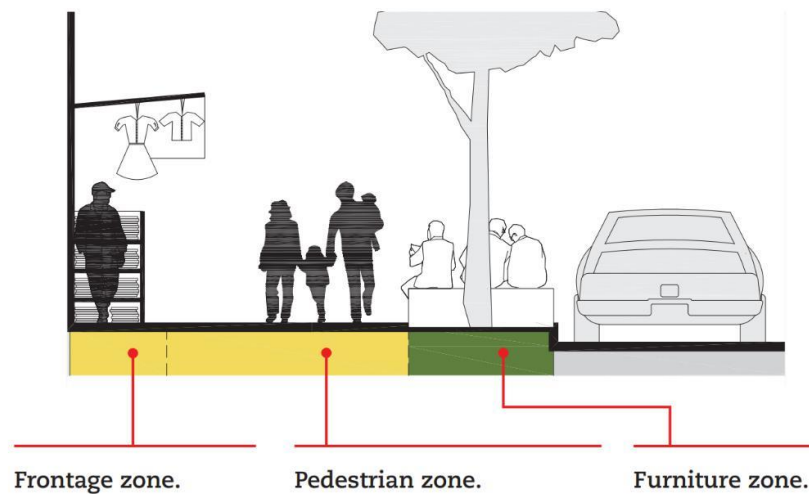


FIGURE 6: FOOTPATH ZONES

Frontage Zone. The frontage zone is also called a trading zone. It is defined by property zone such as retaining walls, fences, pedestrians emerging from buildings, ‘window shopper’, or overhanging vegetation. The frontage zone can vary from a minimum width of 0.5 m along a compound wall to 1.0 m in commercial zones.

Pedestrian zone. This zone is defined for pedestrian movement only. It should be free from all types of obstacles. The pedestrian zone provides continuous clear space for walking. The clear width must be at least 1.8 m to accommodate two wheelchair users at the same time and must be entirely free of obstructions. For high pedestrian volume areas, and additional width would be provided.

Furniture zone. The furniture zone defines the content of street trees and landscaping. This zone acts as a buffer zone between the pedestrian zone and the street traffic zone. The furniture zone consists of street furniture, utility poles, phone booth, parking meters, fire hydrants, manholes, etc. Installing pedestrian pop-outs is an effective way to increase sidewalk space for street furniture and other features. The dimension of the furniture zone must consist of an effective buffer and speed traffic.

2.21. Vending (Management of Street Vendor)

The street vendors make the streets more vibrant by increasing activities, safer through ensuring inflow of people, and inclusive in its true sense by allowing people from different backgrounds to participate in the exchange of goods and services. (Deore, 2008)

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According to Johnathan Crush, the CIGI chair in global migration and development at the Balsillie School of International Affairs, vendors are a net benefit in that they fill an unmet consumer need. "Pedestrians are not just pedestrians, traversing a safe space to get from point A to point B," he explains. "They are also consumers. If they were not, then the informal traders would not be there in the first place. In other words, the question is not just about incomes and the livelihoods of vendors but the interests of consumer-pedestrians." (Nettler, 2013, April 2)

Street vendors are an integral part of urban economies globally, offering easy access to a variety of goods and services to a wide range of populations. It also makes public space safer by contributing "eyes on the street," particularly on streets lined with compound walls. If designed properly, vending can be accommodated in the streetscape without interfering with other uses. The furniture zone of the footpath or a bulb out in the parking lane is an ideal location for vending. The material used for the vending area should facilitate good drainage.

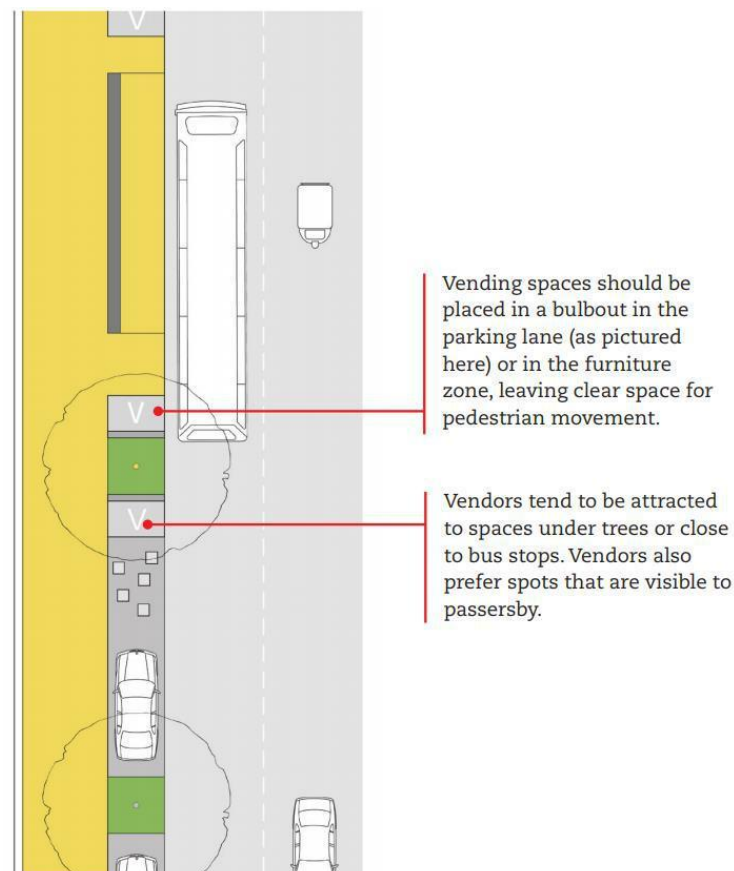


FIGURE 7: VENDING PLACEMENT (JANI & KOSR, 2013)

2.22. Pedestrian Signage

A Planned and cohesive strategy for pedestrian signage usually reduces the number of signs and locations and minimizes maintenance costs, clutter/obstruction, and visual blight. Signage strategies should be based on locating signs at the following specific decision points on the pedestrian network. (NZ Transport Agency, 2009)

Likely trip origins, that is, places where people join the pedestrian network such as transport interchanges/stops, car parks, and key city approaches

- Likely trip designations as when visits to these locations are over they become trip origins. Examples including major junctions and open areas.
- On long routes where pedestrians may be uncertain that they have chosen the correct direction and need confirmation.

The strategy should include all major destinations for pedestrians. Once the destination appears on a sign, it must continue to be signed at every subsequent decision point until a destination is reached. Choosing a destination can be contentious, so community involvement in the process is strongly recommended. (Pandit S. S., 2016)

2.23. Pedestrian Friendly for Elderly and Differently Abled

Disabled and older people are most likely to walk significant distances, despite their difficulty in doing so. Both lacks of accessibility and cost exacerbate this problem. The recommended maximum walking distances are particularly limited for those who walk with an aid such as a stick. Factors such as gradients and weather conditions will also affect the distances people can walk. (Frye, 2013)

Type of Impairment	Recommended distance without a rest
Wheelchair user	150m
Mobility impaired person using a stick	50m
Mobility impaired person without walking aid	100m

(Department for Transport, UK, 2002)

Older pedestrians are at greater risk because of their frailty, with a higher chance of death or serious injury compared with younger adult pedestrians. They are more likely to sustain serious or fatal injuries and to take longer to recover. They are also more

likely to have some functional impairment which adds to the possibility of error in dealing with traffic at road crossings. (Mitchell, C., 2005)

Japan was the first country (in 1967) to introduce warning and guidance surfaces to help blind people navigate city streets independently. Tactile surfaces and audible signals at road crossings are now common in developed countries to provide guidance and warning to blind and partially sighted people. In some countries in Europe, there is also extensive use of way finding techniques using tactile and audible guidance to help people with low vision navigate around cities.

2.24. Design of Pedestrian Precincts

Beginning in the early 1960s, urban writers such as Lewis Mumford, Bernard Rudofsky, Jane Jacobs, and William H. Whyte, among others, advocated for the potential of returning pedestrian street life to cities engulfed by traffic. Studies by sociologists Herbert Gans and Nathan Glazer, among others, pointed out the failure of early urban renewal attempts. European pedestrian experiments provided examples for a new approach to renewal, appropriate for the preservation and revitalization of historic urban centers.

A pedestrian street often features amenities for relaxation, entertainment, or a broader set of activities. The space may be landscaped with trees, flowers, and water. Fountains can be a focus of activity for children as well as adults. Street lighting is usually proportioned to pedestrian scale, with variations for dramatic effect and safety. Amphitheater or speaker platforms are often included in a street's design to encourage the use of the street as a public place. Benches and tables provide places for socializing. The design of pedestrian precincts described in this article include:

- **Pedestrian districts**

Characterized by eliminating vehicular traffic over a portion of a city and considered as a unit for architectural, historic, or commercial reasons. Many European cities have adopted this type of traffic-free zoning because it suits the physical conditions of historic central areas.

- **Pedestrian streets**

Pedestrian streets are individual streets from which traffic has been eliminated. Emergency vehicles, however, have access, and service and delivery trucks are often allowed during restricted hours. The term “pedestrian street” is synonymous with “pedestrian mall,” a term that was first used in North America to describe traffic-free zones, such as a central street.

Many pedestrian streets have been built as an omnibus solution to all of a city’s problems, and in such cases, they have usually failed. Unless a traffic-free zone is conceived in the context of an overall city effort to solve its problems, it cannot succeed for long. Furthermore, the project must be designed at a time and for a place where it can function as designed. Some pedestrian streets have simply been built too late after stores and people have already deserted the downtown. In such cases, eliminating cars is unlikely to turn the tide.

2.25. Pedestrian Crossings

Designated pedestrian crossings are necessary to ensure the safety of pedestrians wishing to cross busy urban roads. The types of pedestrian crossings include Zebra crossing, Pedestrian underpass, and Pedestrian over the bridge. While zebra crossing and crossing at a signalized intersection or midblock crossing permit time segregation, grade-separated crossings such as underpass and over bridge facilitate space segregation.

- **Zebra Crossings**

A zebra crossing is the cheapest device to provide a protected crossing. Zebra crossings are to be provided at the intersections and a midblock location, if necessary. The white stripes and the stop lines forming the complete zebra crossing should be provided in the interest of saving lives, though the painting involves additional expenditure.

- **Crossings at Signalized Intersections**

Pedestrian crossings at signalized intersections are found to be very effective. However, it is necessary to ensure the provision of sufficient green time for the crossing pedestrians, particularly while crossing wide roads. The introduction of a “flashing

green” signal to indicate the approach of the end of the green time for pedestrians will be useful. The adoption of a 4-way simultaneous pedestrian phase in busy commercial areas merits consideration. Kerb railing should be erected on either side of the zebra crossing for adequate length along the road to make the crossing effective.

- **Pedestrian Underpasses**

The provision of a pedestrian underpass (sometimes referred to as subway in India) is an engineering measure towards the reduction of accidents. It involves a high cost of construction and maintenance. In this system, the vehicular movement is at grade and the pedestrian movement is below in tunnels or underground concourses. The advantages of the underpass include the complete elimination of conflicts between pedestrians and vehicles at points of crossings; built-in protection from sun and inclement weather; least disturbance to normal cityscape; and provision of direct linkage to existing underground systems and major activity centers.

- **Pedestrian Over Bridges**

Pedestrians over bridges across roads have generally been unsuccessful, relative to pedestrian underpasses or at-grade crossings. People do not seem to mind walking down first, and by the time they arrive at the other end, are not conscious of the trouble of walking up. In contrast, when they reach over the bridge, people hesitate to climb stairs and look for alternatives. Pedestrians over bridges are likely to be successful only across railway tracks and across wide roads with heavy traffic. Provision of escalators would encourage the aged and the children to use the over bridges.

Happy and healthy living in towns is related to the extent that the town’s open green space system is enough for the requirements. Today, pedestrian zones have been achieved to increase rapidly disappearing open space and to provide comfortable and safe circulation for pedestrians.

2.26. Pedestrianization Scenario of Kathmandu Valley

Nepal is one of the fastest urbanizing countries in Asia with more than 5% average growth rate (World Bank, 2012), and Kathmandu Valley (KV) is perhaps one of the fastest urbanizing cities. With increasing economic growth and rapid urbanization, the city has seen unprecedented growth in motorization. Increasing traffic congestion, road accidents, fossil fuel dependency, air pollution and carbon emissions have led to significant economic, environmental and health cost. Transport is vital for functioning of the city. Policy makers and urban transport planners often use conventional approach of “Predict and Provide” in addressing urban transport problems where future growth of vehicular traffic are predicted and more road infrastructures are ‘provided’ to meet the future growth (Shrestha S. , 2015).

In most cities in developing countries, a large number of citizens walk as part of their daily social, recreational and livelihood activities. Every trip begins and ends with a walking trip. Even taking example of Nepal’s neighboring countries (Policy Brief on non motorized transport, 2012). The research paper also states that in India, 7 15% of the trips in large cities and 13-21% of the trips in small and medium cities are in bicycle. However in Nepal, urban transport planning has been vehicle friendly. The urban transport especially in cities like Kathmandu is planned in such a way that it promotes the vehicle especially private vehicle usage. The increase in motorization is inconvenient and unsafe for pedestrians and cyclists. They impede the mode of transportation for the urban poor who generally depend on walking for movement. This can lead to dramatic increase in road accidents as well as traffic congestions, greenhouse emissions and pollution.

The towns of Kathmandu Valley have traditionally been built as compact settlements that encouraged walking and the use of public open spaces. In recent years, however, rapid and unplanned growth has led to urban sprawl with limited public space, deteriorating environment and chaotic traffic. The Valley with a population of about 2.7 million that is growing at 4.32% per annum is one of the fastest urbanizing cities in Asia. The percentage of urban/built-up area had a noticeable increase, from 3% (2,010 ha) of the total land in 1967 to 25% (16,216 ha) in 2011. During these two decades,

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population growth in the northern and southern areas outside of the Ring Road showed high growth rate of over 8% per annum. In 2022, population in KV is assumed to be 3.8 million, with an annual growth rate of 4.18%, which means a population increase of 57% since 2011 (MoPIT/JICA,2012).

KSTUP report has shown that the worst side of traffic congestion in Kathmandu Valley. The study has pointed out that the traffic congestion in Kathmandu has become serious. Journeys across the city are now measured in hours, not minutes. Roads are saturated. One incident at a junction has implications throughout the entire road network. Frequently traffic is at a standstill, with significant costs in terms of lost time, missed appointments, needless wastage of fuel, pollution and journeys that did not take place. All these impacts are a direct result of no clear policy for managing urban transport in a context of rapid population growth and urban development.

Although there has been a rapid increase in motorization, studies show that walking is still the major mode of travel in Kathmandu Valley. While the share of non-motorized transport (walking and cycling) is still high compared to other travel modes, it has declined significantly in last 20 years. The mode share of walking in 2011 declined to 40.7% from 53.1% in 1991, and cycling from 6.6% to 1.5%, while the share of motorbike has increased almost 3 times, from 9.3% to 26%. Large part of walking and cycling has been replaced by motorbikes (MoPIT/JICA,2012). The average trip-distance for all travel modes and trip purposes is 5km. Interestingly, nearly 28% of travel is done on foot or bicycle by the people who owns private motorized vehicle.

Kathmandu is relatively small city, most of the distance can be easily reached on foot or by cycle. According to study by JICA/GON, 2012, 90% of the trip by walking and bicycle finishes within 30 minutes, and similar is the trip length by cars and motorbikes. Streets in the core city areas ideally designed for pedestrians rather than for vehicular movement. According to the study conducted by CANN in 2012, despite the lack of proper pedestrian infrastructures and decreasing road safety, non-motorized medium of transport still dominates urban transport mode. Walking covers 40.7% of total share but still there has been significant decline in pedestrianization since 1991. Inadequate

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planning for pedestrians has many negative consequences, the most notable being unnecessary fatalities and injuries.

2.27. Pedestrian Schemes in Nepal

Cities in Kathmandu Valley were traditionally designed for walking and space for people to meet. A large number of people in Kathmandu Valley still walk for their daily mobility. Although walking is still the major mode of travel in Kathmandu Valley, it has significantly declined from 53.1% in 1991 to 40.7% in 2012. (MopW/JICA,2012)

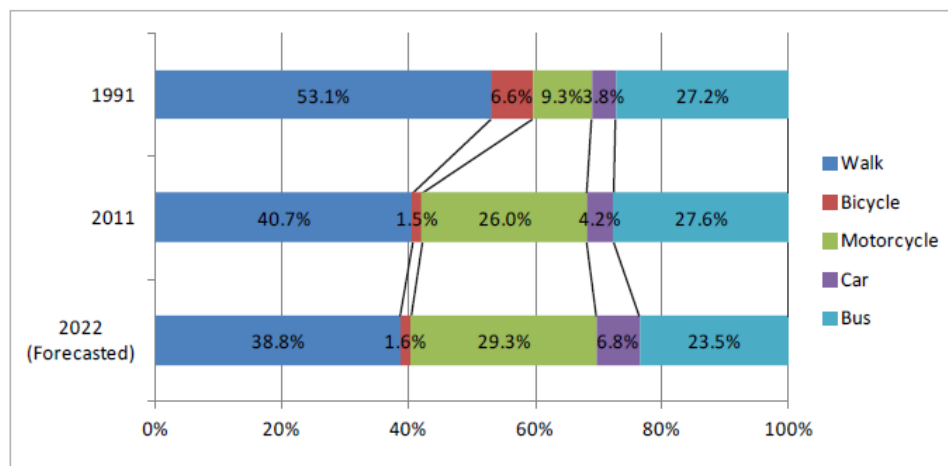


FIGURE 8: TRAVEL MODE SHARE IN 1991 AND 2010 (MOPIT/JICA, 2012)

This is mainly because the plans, policies, and infrastructure development that were adopted are mostly exclusively vehicle-friendly, discouraging people to walk or cycle. Increasing motorization and vehicle-prioritized infrastructure have led to increased congestion, increased dependency on imported fossil fuel. High levels of air pollution and a dramatic increase in road fatalities especially among pedestrians and cyclists.

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The final report of the Kathmandu Sustainable Urban Transport Project has pointed out that the main reason for the chaotic transport system is the demise of government-operated services and public transport is now exclusively provided by the private sector by approximately over 1,000 individuals, owning a variety of different vehicles which are often poorly assigned to routes.

The historic core of Kathmandu is a densely populated built-up area that has developed around an intricate network of roads and alleys linking public squares and community courtyards of varying sizes and characters. The road/alley network is generally poorly surfaced and maintained, or limited width and unsuited to a high and increasing volume of vehicular and pedestrian traffic that it carries. There is no



FIGURE 9: CITIES IN KATHMANDU VALLEY WERE TRADITIONALLY PLANNED AND DESIGNED FOR WALKING

segregation of vehicles and pedestrians in any part of the historic core. (Kathmandu sustainable Urban transport project,2010, page 81)

The resulting environment is extremely congested and subject to high levels of noise and air pollution. These conditions are made worse by the high speeds at which many motor vehicles, especially motor cycles are driven through the area, as well as the encroachment into rights of way by informal hawkers, poorly located utility installations, and open piles of uncollected garbage in the streets. The combined effect of these conditions makes the historic core hazardous, unsafe, and inconvenient for all pedestrians, especially those with impaired mobility. It also creates a negative impression on visitors and has a damaging impact on the economically important tourism industry. Development pressure coupled with high land values has meant that building densities and heights have increased over the years with a corresponding increase in the resident population and vehicle ownership.

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Kathmandu Valley was kept on the endangered list in 2003 with UNESCO making a decision based on the threat of uncontrolled development persists, resulting in the continuous reduction of the urban landscape and architectural fabric of the property, degrading the authenticity and integrity of the property as a whole.

It was later removed in 2007 after the reanalysis of the area and commendable effort from Nepal. Nepal has made several attempts for pedestrianization of historic areas in all the three districts of Kathmandu, Lalitpur, and Bhaktapur. The attempts made in Nepal for pedestrianization of historic areas have been listed as follows:

2.27.1. Kathmandu Valley Long term (2000-2020)

To content urban sprawl, the Kathmandu Valley Long term (2000-2020) Development Concept recommended series of preventive and precautionary land management policies including encouragement of infill development, maximizing land-use efficiency, and minimum average gross residential density. It supports the creation of a car-free zone and pedestrianization. Apart from recommending an action plan to restrict vehicles in prescribed urban core areas, the National Transport Policy (2001/02) doesn't have any specific policies to promote walking.

2.27.2. Kathmandu Valley Urban Development Plans and Programmes

In 1991, draft strategy plans were prepared for Kathmandu Valley. The plan identified ten years investment program. The program had six local area plans two of which focusses on the historic core of Kathmandu and Patan. The study area covered 242 hectares and focusses on the historic quarter of the city with are referred to as “historic core” or simply “core is”

The project focused on various aspects of the core area including infrastructure, transport, land use plans, etc. The strategic plan focused on traffic management in the central business district (CBD) near Durbar Square. Within the historic area, the overall was the reduction of vehicular traffic predominance given to pedestrian movements.

A major route was proposed north-south pedestrian route between Thamel and Teku through Tahiti, Ason, Indra Chowk, and Durbar Square. This route takes into account the main concentration of pedestrian movement in hourly counts. It also takes into

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account the commercial streets, all of the major religious, cultural sites. At the time it was believed that the route could form a “tourist trail” which would guide the visitors to each of the particular points of historic, cultural, religious, or local significance within the central area. The route was supposed to form the core of the wider pedestrianization prohibiting any vehicular movement in the core except for cycles, rickshaws, and carts. All the major Squares including Basantapur Durbar Square, Ason Square, Tahiti, and Indra chowk were pedestrianized. In the case of Ason and Indra Chowk, all the access roads were also pedestrianized while at Tahiti only one of the accesses was allowed to have vehicular movement. The ban was to operate from 9 am to 7 pm.

One of the main objectives of the project was to encourage the use of Bishnumati Corridor Road and the project promoted the concept of making this road ad a public transport route. The project was not successful as vehicular movement could be stopped in Durbar Square. One of the main reasons for its lack of implementation can be that it tried to pedestrianize all the major squares and streets all at once.

2.27.3. Kathmandu Sustainable Urban Transport Project

The project is being assisted by the Asian Development Bank (ADB) which has the vision of Improving walkability or pedestrianization in the city. ADB’s assistance is part of the bank’s Sustainable Transport Initiative (STI). STI was launched in 2006 to enhance ADB’s transport sector interventions by incorporating energy efficiency and inclusive transport infrastructure and services with the explicit aim to reduce the transport sector Green House Gas emissions. The scope of work includes a vision (Strategy) for Sustainable Urban Transport, including immediate measures to:-

- Improve operations of public transport, implement a traffic management plan for the central area of Kathmandu
- Introduce pedestrian areas within the old town of Kathmandu, with links to transport facilities and improve the air quality within the city.

The project is planning to pedestrianize 8km of heritage routes in Kathmandu city core and improve the sidewalk in the city center. The project is also upgrading and/or constructing four pedestrian bridges and improving the interchange facility and public

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space in Kantipath. Street furniture, sidewalk garden, and signposts have also been proposed wherever applicable and appropriate to facilitated pedestrians to walk and relax and create a pleasant walking environment.

KSUTP has tried to control high vehicles volumes through “completing the surrounding strategic road network”. The project also has tried to improve the City’s public transport system to offer visitors to the historic core a viable alternative means of access other than by private motor vehicle. Moreover, it also focusses on increasing institutional capacity, along with the conduct of public information and awareness campaigns to facilitate compliance and understanding of policies and regulations.

This project intended to implement the pedestrianization concept along with other identified projects on the understanding that the cost of these will be 100% financed by KMC from a fund made available from the ADB. It was assumed that in this way residents who might otherwise resist pedestrianization (due to access restrictions) may regard the proposals in a more favorable light if combined with other improvements which have a higher priority for them. The new proposal Kathmandu Sustainable Urban Transport Project (KSUTP) 2013 is being developed.

KSUTP 2013 has proposed a 7.8 km pedestrian-only/vehicle-free corridor will be created from Thamel, through Ason and Indra Chowk to Durbar Square/Hanuman Dhoka and surrounding areas, following in part the alignment of the KMC heritage routes. Except for emergence and certain other vehicles, entry of motor vehicles along the route will be prohibited by a combination of highly visible signs, stepped pavements, and barriers (these will need to be removable for emergency vehicles and services deliveries during permitted periods). The pedestrian route has been divided into three parts:-

2.27.4. Primary Pedestrian Route:

This route consists of all the old lanes from starting from Thamel in the north to Jaisidegal in the south. It consists of all the major squares like Palace Square, Ason Square, and Thahiti to major nodal points like Naradevi, Tangal, Maru Tole, etc.

2.27.5. KMC Heritage Walk:

The chariot route which is also a part of KSUTP's proposed primary pedestrian route is KMC Heritage Walk.

2.27.6. KSUT discovery Walk:

Kathmandu Core area's important courtyard such as Yetkha Bahal, Jana Bahal, Courtyards of Kilagal area and courtyard of Bhotahiti and Chikamugu area have been proposed as KSUT Discovery Walk Lane".

The remaining roads within the Historic Core will be shared vehicle/pedestrian routes, over a total distance of approximately 16kms. Besides, two new bridges are proposed at the Bishnumati area to connect the west part to the historical core. Besides, *Ratnapark* Pedestrian Link has been proposed linking historic core to the site of the Old Bus Park. It will cross Kantipath using the existing pedestrian bridge close to the Army Hospital. The existing footpath linking Kantipath to Durbar Marg will be converted to a 5m bus-only lane.

2.28. Urban form

The term 'urban form' can be used simply to describe a city's physical characteristics. At the broad city or regional scale, urban form has been defined as the spatial configuration of fixed elements (Anderson, 1996)

Features of urban form at this scale would include urban settlement types, such as a market

town, central business district, or suburbs. However, urban form is closely related to scale and has been described as the 'morphological attributes of an urban area at all scales' (Williams, 2000). Characteristics, therefore, range from, at a very localized scale, features such as building materials, façades, and fenestration, too, at a broader scale, housing type, street type, and their spatial arrangement, or layout.

It should be noted that urban form does not simply relate to physical features, but also encompasses non-physical aspects. One can see this in the example of density. Simply put, density is used as a measure of the number of people living in a given area: it is not just a physical, tangible element. Density is also closely linked with the configuration of the social environment and interaction within residential neighborhoods: flats and

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apartments are examples of high-density housing whereas detached and semi-detached properties tend to be of lower densities. There are therefore non-physical economic, social and political processes in place which are physically manifested in housing, schools, parks, and other services and facilities. The scales at which urban form can be considered or measured include the individual building, street, urban block, neighborhood, and city. These levels of spatial disaggregation influence how an urban form is measured, analyzed, and ultimately understood. The issue of scale is discussed throughout this chapter (and the book) as it constitutes an underlying dimension of any examination of urban form.

The urban form generally encompasses several physical features and nonphysical characteristics including size, shape, scale, density, land uses, building types, urban block layout, and distribution of green space. These are categorized here as five broad and inter-related elements that make up urban form in a given city (Fig. 2.1).

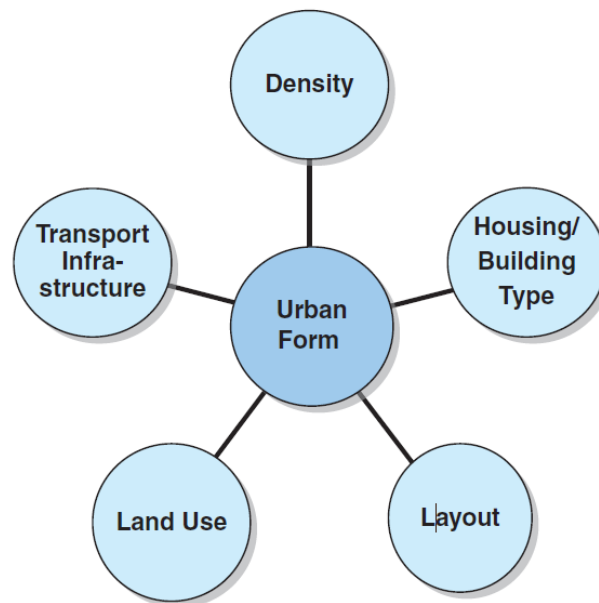


FIGURE 10: ELEMENTS OF URBAN FORM

These elements of urban form have been identified on the basis that they are claimed to influence sustainability and human behavior. They are considered in more detail below. These elements relate to developed, and not developing, countries. For this reason, infrastructure (e.g. water, roads, gas, etc.) is not discussed here as an element of urban

form; however, it is acknowledged that infrastructure would form an important part of examinations of urban form in developing countries.

Density

Density is a deceptively complex concept with several inter-related dimensions. While it may provide an objective, spatially-based, measure of the number of people (living) in a given area, it is also assessed subjectively; it is a social interpretation dependent on individual characteristics and so may differ from resident to resident (Churchman, 1999)

Land Use

Broadly speaking, the term land use is used to describe the different functions of the environment. Within the urban context, the dominant land use tends to be residential but a functional urban area requires industrial, retail, offices, infrastructure, and other uses. The spatial (micro) pattern of land uses is crucial to the arguments about the efficiency of a city and potential 'sustainable' urban forms in influencing urban travel patterns and the quality of life, for example through the existence of green space. There are also certain 'locally-unwanted land uses' such as prisons (Grant, 2002), airports, or landfill sites claimed to be undesirable in residential mixed-use areas (Healey, 1997). Planners have traditionally attempted to separate land uses because of potential undesirable externalities but are now in favor of mixed-use developments.

Accessibility and Transport Infrastructure

Transport infrastructure is closely associated with accessibility as it determines the ease with which buildings, spaces, and places can be reached. The level of accessibility describes the area residents and users can reach, as well as the extent to which they have the means to access places, services, and facilities that are outside their local area (Talen, 2003).

Urban Layout

Layout describes the spatial arrangement and configuration of elements of streets, blocks, and buildings often referred to at the street scale, such as grid or tree-like (cul-de-sac) street patterns. The layout has an important influence on pedestrian movement and how different places and spaces are connected (Department of the Environment

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Transport and the Regions (DETR), 2000). The layout, whether or not it is ‘permeable’ and easy to find the way, controls access and movement for pedestrians, and could influence other aspects of urban form such as land use or density (Hillier, 1984).

3. CHAPTER III: CASE STUDIES

3.1. Case Studies: Pedestrianization of Historical Areas

Kathmandu, Bhaktapur, and Lalitpur municipalities have pedestrianized small stretches of historical squares in Kathmandu, Bhaktapur, and Patan. Motor vehicles are restricted to enter the squares completely or for a certain period. The main objective is to preserve cultural heritage sites, promote tourism, and create a walking environment for pedestrians. However, it is often found that the restriction of vehicles in those pedestrianized areas is not properly regulated.

3.1.1. Bhaktapur

Bhaktapur or bhadgaun is located at a strategic location in a trade route between Tibet and India. In the 13th century, Ananda Malla unified Bhaktapur, the capital city of the valley. The town remained the capital of Nepal Mandala until the kingdom was divided into three states.

The old China-oriented trade route used to be the main road for the city and most shops were oriented along this street. There were two vehicular roads and they form two interconnected circles. The first connected Siddha Pokhari, Durbar Square, and Taumadhi. The second street is the road connecting Dattratraya, Sukuldhoka, and Mahalaxmi (Nagarkot road). These roads are still one of the entry points of the Bhaktapur core area and the place where public vehicles are allowed. Two of the bus stops are located at Mahalaxmi and near Siddha Pokhari. Besides these two lanes, other lanes imposed restrictions on any type of modern transport. BDP proposed certain objectives for the monument zone which were as follows:-

Prohibition of vehicles in monument zone

- All parts of the town should have road access within walking distance from the individual quarter
- Better access to public transport
- Major priority to pedestrians
- Existing roads to be upgraded to modern transport and demand
- All activities causing high speed to be avoided in the inner core
- Heavy traffic outside the built-up area

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The condition of the core area has completely changed since BDP was launched. When the Bhaktapur development project was launched in 1997, there were only around 250 cars or other types of 4-wheelers that entered the city through Sallaghari, BDP project tried to promote rickshaw as an inner transport system that acted as a linkage between trolley bus and minibus stations to the part of the core area. The external transport system was mainly trolley bus which is not in use today. Now the trolley bus station stands as a vegetable market at Surya Vinayak junction.

At that time restrictions were not difficult. Today, the situation has changed as large numbers of people have private vehicles, the land use of the area around Durbar Square including Dattatraya and Taumadi has changed. As a result, vehicular restrictions have somewhat become impossible as the municipality has not been able to provide any other alternative routes. As a result, besides a part of Durbar Square, no other part of Bhaktapur is under vehicular prohibition even though all parts of the core area are within the walking distance from the main roads. The part of palace Square is under full-time vehicular restrictions exception emergencies. The rest of the area has allowed private vehicles, mini trucks, and even tractors that have somewhat damaged its brick pavements. But the public vehicles are only allowed till the bus stops off Dudhpati, Byasi, and Surya Vinayak.

Besides public need, land use of Durbar Square seems to be one of the major reasons for vehicular movement in the area. There is highly commercialization and institutionalization of Durbar Square that had demanded vehicular movement. For examples shops and cafes in the three squares have not only increase vehicular movement but have increased the number of parking on the square as well. Bhaktapur Municipality building has been the major cause of vehicles in the square.

3.1.2. Lalitpur

Lalitpur, which was called “Lalitputtana” referring to a beautiful city was one of the “Mahanagar” (big cities) of medieval times. Patan Durbar Square is situated at the center of Lalitpur city. It is one of the three Durbar Squares in the Kathmandu Valley, all of which are UNESCO World Heritage Sites.

The Durbar Square is a marvel of Newar architecture. The Square floor is tiled with red bricks. There are main temples and idols in the area. The main temples are aligned

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opposite of the western face of the palace. The entrance of the temples faces east, towards the palace. There is also a bell situated in the alignment beside the main temples. The Square also holds old Newari residential houses. There are various other temples and structures in and around Patan Durbar Square build by the Newar people.

Planning of Palaces Squares has been done in such a way that it lies at the nearest distance from various points and settlements. This is one of the main reasons for Patan not being able to remain untouched by the urban pressure of the valley. This is the main reason given by the Lalitpur sub-metropolitan office for not being able to pedestrianize the whole of the palace square even though the local body has made a couple of attempts for pedestrianization of the square. In 2058/2059, the municipality attempted to prohibit vehicular movement in Patan Dhoka, kwalukha, Balhalcha, and Nakhu bahi but failed deliberately. The municipality is also trying to propose the Bagmati corridor road as the alternative route. Talking about various attempts in Patan Kunti Mahapal road was one of the first few roads which were widened by demolishing the face of the houses. Today, Mahapal Street is one of the major vehicular entries to the Durbar Square from the Pulchowk area.

Being in proximity with the commercial area of Lalitpur, commercialization has swept through the palace square with shops, cafes, and street vendors. Besides, it is directly linked to Shankamul too. On top of that, it is the linkage of Pulchowk to Gwarko. Thus, it houses autos, public vans, and taxis Patan Durbar Square is also the space for vehicular movement and parking. One of the main reasons for such activities is the commercialization of the historic area which is also seen in Kathmandu Durbar Square. Like the other two palace squares, Patan not only faces the problem of vehicles but also the haphazard parking which has been managed by local clubs under the municipality as the information from Lalitpur sub-metropolitan office.

3.1.3.Thamel, Kathmandu

Thamel which is a major tourist hub of Kathmandu was declared a vehicle-free zone on October 22, 2016. A team from Metropolitan Traffic Police Division and Thamel Tourism Promotion Council, along with local leaders, gathered on the spot and formally

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announced the drive-by placing several "Vehicle Free Zone" boards on the streets (Pradhan, 2016).



FIGURE 11: VEHICLE FREE ZONE IN THAMEL

A certain stretch of Thamel which is a commercial, tourist center has been pedestrianized. The Metropolitan Police Department has declared exit ways from Thamel through Saat Ghumti Chowk, Pakanajol-Sorhakhutte Height, Chhetrapati, Bhagwati Bahal, Amrit Marga, and Thahity. Vehicles can move towards Thamel only via Tridevi Marga. Jyatha Marg and Tridevi Marga are being operated for a two-way road system. Two-wheelers can ply from Chhetrapati to JP marga, Thahity to reach Thamel.

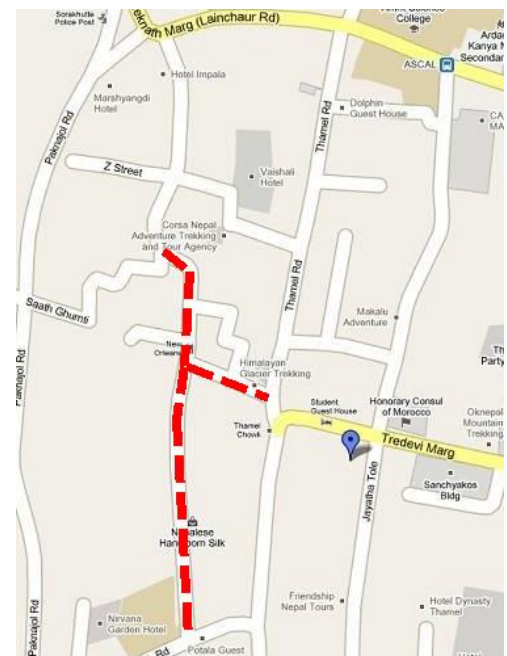


FIGURE 12: VEHICLE FREE STREETS OF THAMEL

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It is not a complete blanket ban on vehicular movement inside the Thamel, vehicles have been restricted into certain routes. In its preliminary phase, the vehicle-free zone has covered a few road sections but has been planned to expand gradually.

A canopy of prayer flags allows for an experience of smaller space within the larger volume which helps in providing human scale to the setting.



FIGURE 13: PEDESTRIANIZED STREET OF THAMEL

Vehicles carrying essential items like Ambulances, water tankers, and tourist buses among others are allowed to enter the area. Those Thamel residents who own vehicles have been provided with passes for their convenience. Businesspersons and hotel owners have to get their supplies by vehicles during the night--between 10 pm and 7:30 am.

Before the implementation of the plan, various stakeholders including civil societies, local clubs, and tourism entrepreneurs had held several rounds of discussions with the Metropolitan Traffic Police Division and Thamel Tourism Promotion Council concerning this drive.

There are concerns from hoteliers and entrepreneurs regarding the supply of items and receiving foreign guests and the council has ensured special passes and necessary arrangements for the effective implementation of the plan. (Kafle, 2017)

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The drive aims to make the movement of foreign tourists hassle-free, ensure the safety of pedestrians and make Thamel a more livable place in Kathmandu. This initiative is part of a long-term vision of promoting this popular tourist destination as a walking zone as in other tourist spots of the world.

3.2. Perugia - Favoring Pedestrians

Perugia, Italy is a city with a well-known cultural wealth and history. It has a mountainous location, which forms a barrier between the upper, older part of the city and the lower, more modern part of the city. The growth of car traffic experienced in Perugia led to environmental problems and posed a risk to the city's historical heritage. A travel plan for Perugia involves the development of a pedestrian network, the establishment of a parking guidance system, and the establishment of a transport assessment system to consider the externalities of different transport modes. The main objective of Perugia's travel policy is the enhancement of the city's historic heritage by reducing the space occupied by vehicles and eliminating vibrations caused by vehicles.



This has been accomplished by developing a pedestrian network and encouraging the use of public transit and other alternative transport modes. The pedestrian network has been developed through the establishment of a pedestrian zone in the historic center; the establishment of controlled traffic zones authorizing access to residents only; and the creation of mechanized pedestrian ways, including elevators, escalators, and pedestrian walks of special design.

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The pedestrian network has been successfully implemented, and there is already a demand for its extension. The pedestrian network has proven popular. Most trips to the city center are made on foot. The escalators, which provide comfortable and continuous route ways, are the most popular. The elevators, which serve discontinuous routeways, are also generally accepted. Studies have shown that 50 % of the local population in Perugia considers 600 meters or more to be an acceptable walking distance. A considerable proportion of the local population prefers to combine public transport with other modes of transport.

4. CHAPTER IV: METHODOLOGY

4.1. Choice of Methodology

In this particular research, data required for achieving stated objectives required a particular way of looking at the research problem. For this suitable research, a paradigm needs to be associated with the study. A paradigm is a “worldview” or a set of assumptions about how things work. It, according to Bogdan & Biklen (Mackenzie, 2006) is a loose collection of logically related assumptions, concepts, or propositions that help orient thinking and research paradigm is a theoretical framework of research that influences the way knowledge is studied and interpreted.

The Nature of Research requires both **qualitative and quantitative research approaches (viz. Pragmatic Paradigm)**. The first objective, to find out factors determining pedestrian traffic have multiple realities in play and needs to look upon objectively. The **epistemological Position** of research is **post-positivist** where observations may involve error and reality is imperfect. **Post positivism** recognizes that all observation is fallible and has an error and that all theory is revisable. **Postpositivism** is influenced by a philosophy called critical realism (Trochim, 2006). Critical realism, however, recognizes that observations may involve error and that theories can be modified (Trochim, 2006). Reality cannot be known with certainty. Co relational research methodology based on inductive logic needs to be applied where broad generalizations are made from specific observations. In co-relational research, researchers do not influence any variables but only measure them and tries to find the relationship between different variables. Inductive logic is the logic of evidential support. Inductive reasoning makes broad generalizations from specific observations (Trochim, 2006). In inductive logic, after observations, a pattern is discerned and generalizations are made to infer an explanation or a theory. The conclusion is likely based on-premises and involves a degree of uncertainty. The quantitative method of data collection – Literature review, collection, and analysis of needed statistical data, questionnaire survey, etc. will be used.

The second objective is to study the implication of pedestrian traffic on elements of urban form and the third objective is to give recommendations regarding pedestrian traffic management. Here, the epistemological Position is Interpretivist where there are

multiple subjective interpretations of social reality. Creswell (Pham, 2018) states that, in interpretive paradigm, the researchers tend to gain a deeper understanding of the phenomenon and its complexity in its unique context instead of trying to generalize the base of understanding for the whole population. Since, the policy can be interpreted differently by multiple stakeholders including the researcher, policymakers, and the end beneficiaries, it is relativist ontology. Pham (2018) states that in relativist ontology, a single phenomenon may have multiple interpretations rather than a truth that can be determined by a process of measurement. Relativist ontology is subjective. So, qualitative Interpretation needs to be applied to gain subjective understanding. **Qualitative method** of data collection – **Long Interviews, Analysis of related documents (Policies, Laws), etc.** will be used.

The analytic framework is largely concentrated on the qualitative and quantitative aspects of pedestrian planning,

4.2. Secondary Data Collection

The secondary data as per the analytical framework drawn were collected through concerned line agencies working for pedestrian planning. The Department of Road, responsible for maintaining the transport data was consulted for acquiring secondary data. The land use and census data were collected through the CBS office. Kathmandu Metropolitan city was contacted regarding the problems and issues of pedestrian planning in Kathmandu. The budgetary expenditure on pedestrian facilities was collected from KMC, DOR, DUDBC, and DOTM. The necessary collected data of pedestrians and shape files for the GIS application was sought from the concerned authorities like NEPECON and Genesis in Kathmandu. The library reference, internet resource, and previous work done regarding pedestrian planning was referred to as the secondary data sources.

4.3. Primary data collection

Primary data collection in the field was carried out as per the requirements of the case study. Manual pedestrian counts was done to collect a range of data for pedestrian flows. The inventory phase requires the collection of basic data about the study area, including physical features, land use, and characteristics of the daily pedestrian population.

The physical inventory of the study area includes the plan configuration and dimension of each street and sidewalk.

Theoretically, all pedestrian trips was determined by inventory including their origin and destination, trip purposes, time of day, and volume. But, due to time constraints, combinations of sampling techniques and analytic techniques are used to develop this data. These techniques include cordon counts, direct observation at the site, etc.

- Cordon counts
- Manual Field count
- Special entrance count

4.4. Methods of Data Collection, compilation, and analysis

Data Analysis:

The collected data was processed and analyzed quantitatively and qualitatively and data variables will be compared and correlated to arrive at the logical conclusion of the research questions. The quantitative data was analyzed as per the prevailing analytical formulation drawn from the works of literature and secondary sources. These data was spatially and quantitatively analyzed with the help of GIS and SPSS applications.

Synthesis and Conclusion:

The data analysis process give rise to the synthesis process where the conclusions are drawn which will be seeking answers to the research questions of the thesis study. The synthesis part also carve the way for certain recommendations for the policy aspects of the research objectives.

Report preparation and Presentation:

The report preparation and presentation was the final part of the thesis where all the parts of the research methodology was incorporated in a narrative way putting forward all the data collection, analysis, and the conclusion arrived in an elucidative manner.

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The final report was summarized and depicted in points and presented in front of the jury as the final presentation.

Selection of location of station was carried out on the basis of direction of pedestrian movement. For pedestrian counting along the direction of traffic the following location were selected.

- 1) Bansantapur Dabali
- 2) Sukrapath(left and right of footpath)
- 3) Machhindra bahal(Ason –Indrachowk)
- 4) Ugratara mai temple(Ason-Bangemuda)
- 5) Ganesh Temple(Bangemuda-Bhedasing)
- 6) Kilagal(Bhedasing-Naradevi)
- 7) Santaneshwor Mahadev Temple(Naradevi-Basantapur)
- 8) Mahadev Temple(Basantaur-Indrachowk)

Manual pedestrian count were done to collect a range of data for pedestrian flows. As per the observed data on each predefined location the average peak pedestrian traffic data were determined.

Vehicular count is done on streets with most four wheeler vehicular movement. Structured and semi structured Questionnaire survey of 73 pedestrians is carried out by random sampling regarding origin and destination of the trip, trip purpose, reasons for choosing pedestrian travel mode, route selected, reasons for the route selection, problems faced, opinion on street vendors, opinion on pedestrianization.

Structured and semi structured interview carried out for the shopkeepers regarding their mode of transport of goods for their business. Direct and participant observation on site is carried out for land use street, appearance, formal and informal activities, parking, street character (physical, social, cultural) and street infrastructure. Street width, Building heights, façade, building use is noted on field by measurement and observation. Block size, connectivity, alternate pathways is studied on maps.

4.5. Research Ethics

Ethics is moral principles that govern a person's behavior or the conducting of an activity. Research ethics deals primarily with the interaction between researchers and the people they study. Parveen and Showkat (2017) have referred to research ethics as doing what is morally and legally right in research. They are norms for conduct that distinguish between right and wrong, and acceptable and unacceptable behavior. The principal concern in research is respect for the participant's" dignity, rights, safety, and well-being (Parveen, 2017). Since ethics are a fundamental requirement of the research process; this research has maintained ethical considerations as far as possible.

In this research, during the preparation of questions for the questionnaire survey, discriminatory and ambiguous questions are avoided and questions are made objective as much as possible. During the operationalization of the questionnaire survey in the field, respondents were chosen from voluntary participation. There was no forced participation. There was no discriminatory behavior based on gender, ethnicity, economic background, etc. towards the respondents.

5. CHAPTER V: STUDY AREA

5.1. Historic core of Kathmandu

The historic city core of Kathmandu consists of unique arts and architecture amidst vibrant culture, tradition, and ritual practice. Its traditional compact planning is interrupted by spaces endowed with a special character that is testimony to the existence and development of the spirit.

The formation of the town:

The town evolved as the trade route to Tibet dating back to the 10th century. The route is the diagonal street between present-day Tankeswari bridge and Kamaladi, Chhetrapati, and Te Bahal. This was probably the first built axis that gave form to the town. The axis also contributed to the connection of Basantapur Palace Square with another major square called Ason.

Kathmandu city was made the capital of Nepal after the unification of the nation in 1769AD, and it was already a dominant and flourishing urban center then. According to the legend, king Gunakamadeva chose the shape of a sword for the city plan of Kathmandu in 724AD, symbolizing the Hindu goddess. The development of the city continued through many ruling dynasties over the centuries.

The old core of Kathmandu has been built in the form of a sword with the handle to the south and blade to the north. Most of the data tend to support the idea that different settlements have been unified to form the large town of Kathmandu which is known as Mahanagara. According to Wolfgang Korn, has mentioned in the Traditional Architecture of Kathmandu Valley that two settlements or units form the northern part and one from the southern part forms the town. The northern part is called Koligrama or Yambu whereas the southern part is called Dakshina Koligrama or Yang. Dakshin koligrama., the southern settlement in the south of Hanuman Dhoka was more important and densely populated than its north. It was also a famous site for holding major festivals and cultural programs. Even today the locals, Newars use the term to describe various parts of the town like Thane for the upper part, Dathu for the middle, and Kone for the lower part of the town.

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After the end of the Lichhavi period, Kathmandu valley remained in dark for a few centuries until the advent of the Malla period(1200-1769AD). The Malla rulers made their palaces at the present Hanuman Dhoka area and developed it as the central seat of government and urban civic life. By the early 12th century, Daksinakoli/Yangala was known as Kasthamandapa, derived from wood. Even today the alternative name of Kathmandu is Kasthamandapa.

Basantapur Durbar Square:

The boundaries and buffer zones for Hanuman Dhoka Durbar Square were approved by the World Heritage Committee during their 30th sess^{io}n in July 2006. The boundary covered an area of 5.09 approximately (Kathmandu Valley World Heritage Site, Integrated Management Framework,2007, page 11). The boundary encompasses the main monuments and the surrounding context of squares and open spaces, thereby ensuring the identity of the Monument Zone is retained. The Buffer Zone includes a strip of urban fabric surrounding the Monument Zone and corresponds to the area gazette in 1989 which was 6.47 ha approximately as per data from Kathmandu Valley World Heritage Site, Integrated Management Framework, 2007.

In the past, the core area of Kathmandu was considered a classic example of urban form and architecture with universal value and was highly touted as a “living museum”. Even though the palace squares were developed in the medieval period, centuries back but there was very little change in the area until 1934. Since 1934, there have been changes, the process of expansion and renewal contrast to the architectural and planning traditions of Newari culture. Following the earthquake of 1934, the different architectural and physical layouts of New Road and Dharmapath were created. Since, the time, the commercialization of the area started and now it is one of the most important CBD (Central Business District) of Kathmandu. The development of New Road is one of the main reasons behind the commercialization of the monument zone.

Another factor that led to the transition of “modern development” began with the decentralization of the Rana elite and the construction of the road to serve their needs. This led to the development of the Kantipath area. This led to the development of so-called contemporary planning which has somewhat affected the core of Kathmandu.

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The Kathmandu Durbar Square holds the palaces of the Malla and Shah Kings who ruled over the city. The core area comprising of palaces, temples, houses belonging to the 15th-18th century is known as the Kathmandu Palace Square Monument Zone. Along with these palaces, the square surrounds quadrangles revealing courtyards and temples. It is known as Hanuman Dhoka Durbar Square, a name derived from the stature of Hanuman, the monkey devotee of Lord Ram, at the entrance of the palace.

However, it is the layout of streets, squares, and public spaces that presents the unique visual and spatial characteristics of the gigantic scale and majestic presence of those monuments, palaces, and temples.

The Durbar Square is located in the heart of old Kathmandu city and impresses with its intricate wood carvings and rich history. The complex of palaces, courtyards, and temples has been built between the 12th and the 18th centuries by the ancient Malla Kings of Nepal. Once the residence of Nepal's Royal Family. All coronation ceremonies were held here. The rest-houses, temples, residences, sculptures, platforms, etc. shapes the Durbar Square. Due to its architectural excellence, urban elements, and rich culture and tradition Basantapur Durbar Square was declared as one of the seven monument zone of Kathmandu World Heritage Site by UNESCO in 1979. The monument zone has been demarcated up to certain areas as shown in the figure. Kathmandu Durbar Square has been inscribed in the UNESCO world heritage list on basis of cultural heritage criteria, II, IV, and VI. The Durbar Square is surrounded by concrete buildings, the complex is the social, religious, and urban focal point of the city and an oasis in a fast developing, chaotic modern city.

The Monumental Zones represent the highly developed architectural expression of the religious, political, and cultural life of Kathmandu Valley, with a concentration of monuments unique and unparalleled in the world. 'The city of Kathmandu is a melting pot for the nation's population, not only today but also in times past, which probably explains the rich cultural heritage of the city. Kathmandu with its unique architectural heritage, laces, temples, and courtyards has inspired many writers, artists, and poets, both foreign and Nepalese. It boasts a unique symbiosis of Hinduism, Buddhism, and Tantrism in its culture, which is still as alive today as it was hundreds of years ago. The

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religious influence can be openly seen in the city. Most of the principal monuments are in Durbar Square, the social, religious and urban focal point of the city, built between the 12th and the 18th centuries, the ancient Malla Kings of Nepal”. (Source: UNESCO/CLT/WHC).

Today, Kathmandu is the political as well as economic capital of the country. The increasing economic activities in the town have led to the commercialization of spaces. In the years, even the palace squares which have been proclaimed as monument zones cannot remain untouched from the rapid urbanization. Development pressure coupled with high land values has meant that building densities and heights have increased over the years with a corresponding increase in the resident population and vehicle ownership. Prevailing development controls and building regulation are largely ignored and there is little or no attempt to conserve buildings of architectural or historic significance. A significant loss of heritage has occurred. Despite this, there are still five recognizable land use zones within the core in which certain land and building use predominate. To add to the sorrow, the identity of Basantapur was further destroyed by the devastating earthquake of April 2015.

5.2. Background

The narrow streets of Ason and Indrachowk are the traditional markets and business areas that are situated in the heart of Kathmandu. Ason is the junction of six streets where anyone can be overwhelmed by the activities taking place there is increasingly from dawn till twilight. One of the streets leads to Indrachowk toward the Hanuman Dhoka Palace. Both the sides of the street are packed with assorted shops selling metal vessels, ceramic pots, vegetables, grains, garments, handicrafts, pashminas, rugs, and so on. Rickshaws, motorbikes, cycle riders, street vendors, pedestrians all seem to be pushing one another to make their way. It is very interesting to stroll in this traditional market. After a tour of Kathmandu Durbar Square majority of people stroll from Indrachowk to Ason and take the street that leads towards the touristic Thamel area. The streets of Makkhan, Indrachowk, Bhedasing, Kilagal, and Phyaphal are the traditional streets located close to Ason and Basantapur Durbar Square.

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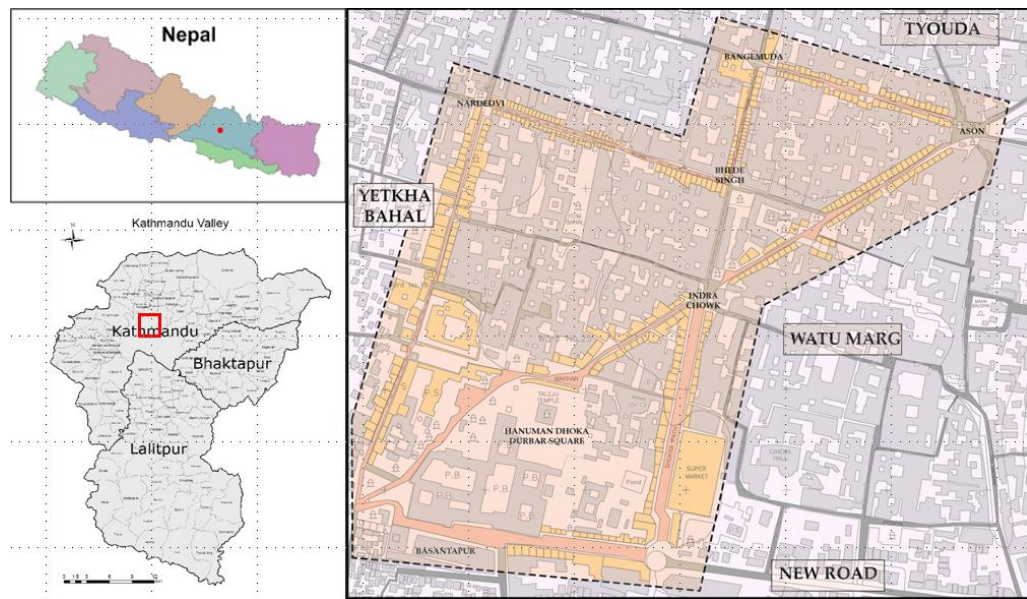


FIGURE 14: STUDY AREA AT THE URBAN CORE

The Bhedasing Chowk and the street of Kilagal are the vegetable markets. Makkhan is highly a commercial area that leads directly to Kathmandu Durbar Square. Indrachowk is the busiest marketplace after Ason which is traditionally a center for the sale of blankets and cloth, and there are often many merchants on the platforms of the Mahadev Temple. Street of Phyaphal directly leads to the Basantapur Durbar Square as well. Thus the proximity of these streets to the traditional markets and business areas of Ason and the world heritage site Kathmandu Durbar square in conjunction the dense residential area of the urban core has made them very busy and major streets to commute to other parts. These streets are vibrant and very busy owing to the uninterrupted flow of pedestrians and two and four-wheelers all day long.

These streets were designed for pedestrians of the past and suited perfectly in the old arena. But, things have changed tremendously since then. The rapid modernization and change in lifestyle along with the skyrocketing population have severely jeopardized these streets. They are no longer pedestrian streets only but are also heavily occupied by vehicles. Today, along with pedestrians, two-wheelers, private cars, public automobiles, school vans, and heavy trippers run in these streets. Further, the high pedestrian flow attracted a large no. of street vendors to run their business on the sides of these streets along with local shopkeepers encroach the street leaving very little space for pedestrians to walk smoothly.

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5.3. Pedestrian Count Station

The movements of pedestrians along the direction of roadway length have been considered for analysis. The major data collection station have been identified as follows:

- 1) Bansantapur Dabali
- 2) Sukrapath(left and right of footpath)
- 3) Machhindra bahal(Ason –Indrachowk)
- 4) Ugratara mai temple(Ason-Bangemuda)
- 5) Ganesh Temple(Bangemuda-Bhedasing)
- 6) Kilagal(Bhedasing-Naradevi)
- 7) Santaneshwor Mahadev Temple(Naradevi-Basantapur)
- 8) Mahadev Temple(Basantaur-Indrachowk)

Pedestrian count was carried out for 11 hours (from 8AM to 7PM) of duration for each 15 minute of time interval.



FIGURE 15: PEDESTRIAN COUNT STATIONS

6. CHAPTER VI: FIELD DATA AND ANALYSIS

6.1. Pedestrian Count

The total distribution of pedestrian volume during eleven hours (from 8 AM to 7 PM) has been observed as follows;

1. Pedestrian count Survey at Basantapur Dabali

TABLE 1: PEDESTRIAN COUNT DETAILS AT BASANTAPUR DABALI

Direction: Along footpath	From: Newroad To: Basantapur	From: Basantapur To: Newroad	Total Count	Hourly Count
Time Counted	No. of Pedestrian	No. of pedestrian		
8:00-8:15	111	194	305	
8:15-8:30	82	108	190	
8:30- 8:45	95	121	216	
8:45-9:00	75	186	261	972
9:00-9:15	80	287	367	
9:15-9:30	158	322	480	
9:30-9:45	197	343	540	
9:45-10:00	257	337	594	1981
10:00-10:15	209	371	580	
10:15-10:30	142	360	502	
10:30-10:45	171	340	511	
10:45-11:00	136	213	349	1942
11:00-11:15	122	227	349	
11:15-11:30	131	143	274	
11:30-11:45	147	171	318	
11:45-12:00	169	193	362	1303
12:00-12:15	181	203	384	
12:15-12:30	273	247	520	
12:30-12:45	274	245	519	
12:45-1:00	248	291	539	1962
1:00-1:15	287	266	553	
1:15-1:30	273	286	559	
1:30-1:45	306	269	575	
1:45-2:00	307	303	610	1793
2:00-2:15	286	310	596	
2:15-2:30	335	342	677	
2:30-2:45	248	206	454	
2:45-3:00	228	213	441	2168
3:00-3:15	257	199	456	
3:15-3:30	269	207	476	
3:30-3:45	226	190	416	
3:45-4:00	285	313	598	1946
4:00-4:15	304	271	575	
4:15-4:30	210	221	431	
4:30-4:45	237	176	413	
4:45-5:00	269	214	483	1902
5:00-5:15	138	95	233	
5:15-5:30	139	129	268	
5:30-5:45	272	200	472	
5:45-6:00	276	147	423	1396
6:00-6:15	293	202	495	
6:15-6:30	326	182	508	
6:30-6:45	372	268	640	
6:45- 7:00	317	178	495	2138
Total	9718	10289	20007	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

The peak 15 min pedestrian volume is 677 during the time interval of 2:15 to 2:30 hrs. However, the largest hourly pedestrian falls under the time interval of 6:45 to 7:00 hrs as in the table and graph furnished below.

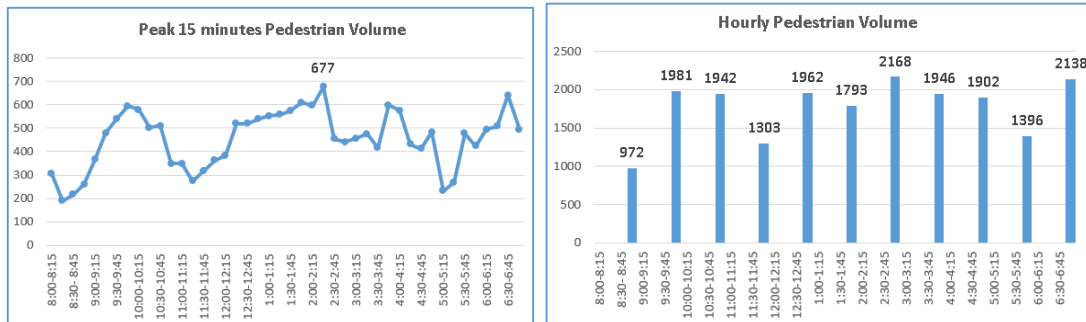


FIGURE 16: PEAK 15-MIN AND HOURLY COUNT

The pedestrians are pulled more towards Newroad than Basantapur in this observation segment. There is a rise in pedestrian traffic as the day goes by and reaches a peak in the evening around four o'clock. The area has more pedestrian trip attractions towards the commercial are like BishalBazaar, Newroad, and the traffic nodes like Bhugol Park.

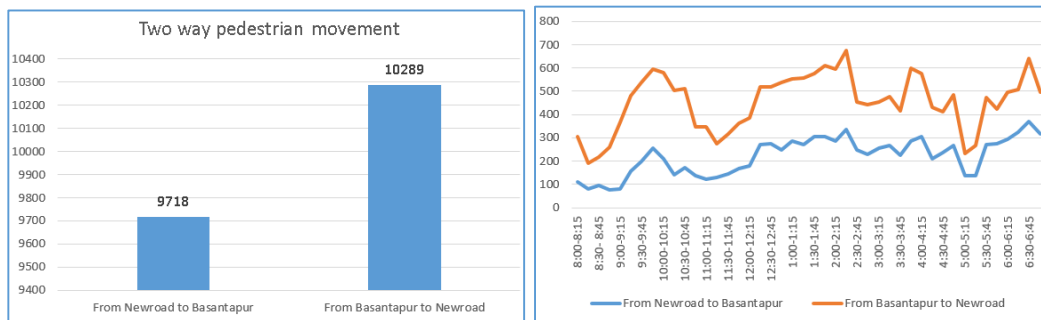


FIGURE 17: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

2. Pedestrian count Survey towards the Left side of Footpath

TABLE 2: PEDESTRIAN COUNT DETAILS AT SHUKRAPATH (LEFT)

Direction: Along footpath	From: Indrachowk To: Darmapath	From: Darmapath To: Indrachowk	Total Count	Hourly Count
Time Counted	No. of Pedestrian	No. of pedestrian		
8:00-8:15	60	43	103	
8:15-8:30	79	56	135	
8:30- 8:45	58	47	105	
8:45-9:00	67	57	124	467
9:00-9:15	66	61	127	
9:15-9:30	71	49	120	
9:30-9:45	79	50	129	
9:45-10:00	113	58	171	547
10:00-10:15	100	53	153	
10:15-10:30	128	65	193	
10:30-10:45	123	71	194	
10:45-11:00	136	83	219	759
11:00-11:15	139	89	228	
11:15-11:30	147	111	258	
11:30-11:45	165	134	299	
11:45-12:00	145	147	292	1077
12:00-12:15	110	143	253	
12:15-12:30	168	156	324	
12:30-12:45	193	178	371	
12:45-1:00	225	173	398	1346
1:00-1:15	249	189	438	
1:15-1:30	221	249	470	
1:30-1:45	202	277	479	
1:45-2:00	213	261	474	1861
2:00-2:15	211	252	463	
2:15-2:30	231	226	457	
2:30-2:45	258	204	462	
2:45-3:00	274	229	503	1885
3:00-3:15	362	251	613	
3:15-3:30	343	134	477	
3:30-3:45	353	238	591	
3:45-4:00	291	223	514	2195
4:00-4:15	201	202	403	
4:15-4:30	214	183	397	
4:30-4:45	216	157	373	
4:45-5:00	218	189	407	1580
5:00-5:15	220	203	423	
5:15-5:30	255	217	472	
5:30-5:45	288	197	485	
5:45-6:00	253	176	429	1809
6:00-6:15	200	165	365	
6:15-6:30	217	162	379	
6:30-6:45	230	179	409	
6:45- 7:00	179	173	352	1505
Total	8271	6760	15031	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

The peak 15 minute pedestrian volume is found to be 613 pedestrians at the time interval of 3:00-3:15 hrs. Similarly, the largest hourly pedestrian throughout is 2195 which falls under the time interval of 3:45-4:00 hrs.

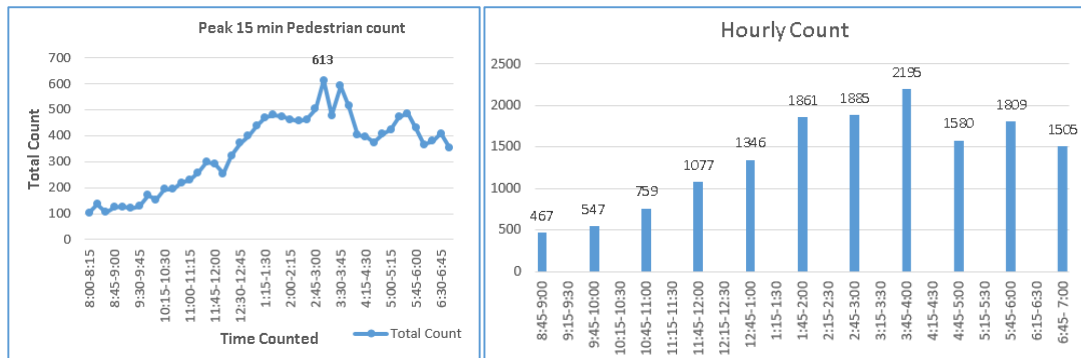


FIGURE 18: PEAK 15-MIN AND HOURLY COUNT

The pedestrian at Shukrapath is more attracted to the commercial area towards Dharmapath than Indrachowk which is on both sides of the footpath, it is evident from the graph below.

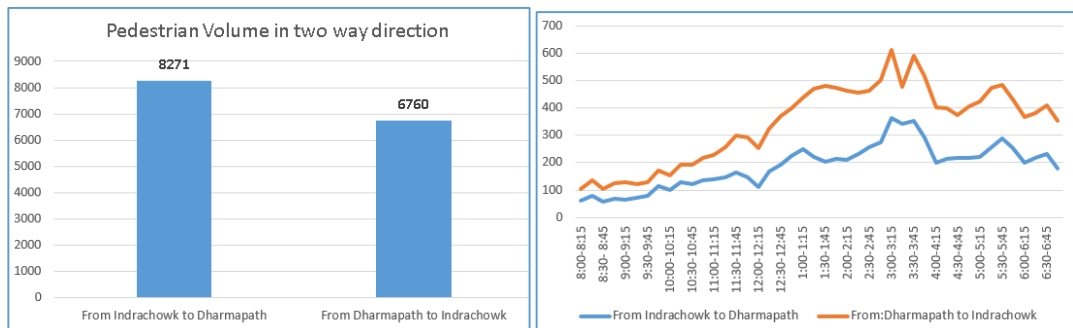


FIGURE 19: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

3. Pedestrian count Survey towards the Right side of Footpath

TABLE 3: PEDESTRIAN COUNT DETAILS AT SHUKRAPATH (RIGHT)

Direction:	From: Indrachowk	From: Darinapath	Total	Hourly
Along footpath	To: Darinapath	To: Indrachowk	Count	Count
Time Counted	No. of Pedestrian	No. of pedestrian		
8:00-8:15	21	40	61	
8:15-8:30	30	49	79	
8:30-8:45	39	55	94	
8:45-9:00	49	70	119	353
9:00-9:15	47	41	88	
9:15-9:30	44	59	103	
9:30-9:45	40	57	97	
9:45-10:00	38	66	104	392
10:00-10:15	41	71	112	
10:15-10:30	47	69	116	
10:30-10:45	48	78	126	
10:45-11:00	51	56	107	461
11:00-11:15	63	84	147	
11:15-11:30	79	93	172	
11:30-11:45	81	109	190	
11:45-12:00	72	118	190	699
12:00-12:15	97	126	223	
12:15-12:30	117	139	256	
12:30-12:45	113	141	254	
12:45-1:00	109	137	246	979
1:00-1:15	121	147	268	
1:15-1:30	130	154	284	
1:30-1:45	153	299	452	
1:45-2:00	162	385	547	1551
2:00-2:15	163	375	538	
2:15-2:30	161	381	542	
2:30-2:45	154	327	481	
2:45-3:00	150	213	363	1924
3:00-3:15	178	202	380	
3:15-3:30	188	193	381	
3:30-3:45	201	162	363	
3:45-4:00	180	192	372	1496
4:00-4:15	169	185	354	
4:15-4:30	172	178	350	
4:30-4:45	163	188	351	
4:45-5:00	157	208	365	1420
5:00-5:15	138	187	325	
5:15-5:30	117	148	265	
5:30-5:45	132	205	337	
5:45-6:00	144	243	387	1314
6:00-6:15	128	207	335	
6:15-6:30	117	183	300	
6:30-6:45	119	167	286	
6:45-7:00	113	126	239	1160
Total	4836	6913	11749	

The peak 15 minutes of pedestrian traffic occurs at the time interval of 1:45-2:00 hrs and the pedestrian volume is 547. Eventually, the peak hourly traffic flow also falls on 2:45-3:00 hrs with the largest traffic volume of 1924.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

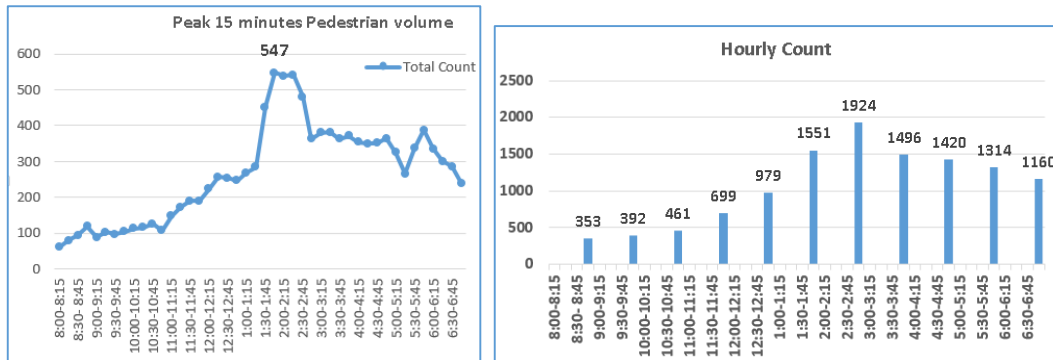


FIGURE 20: PEAK 15-MIN AND HOURLY COUNT

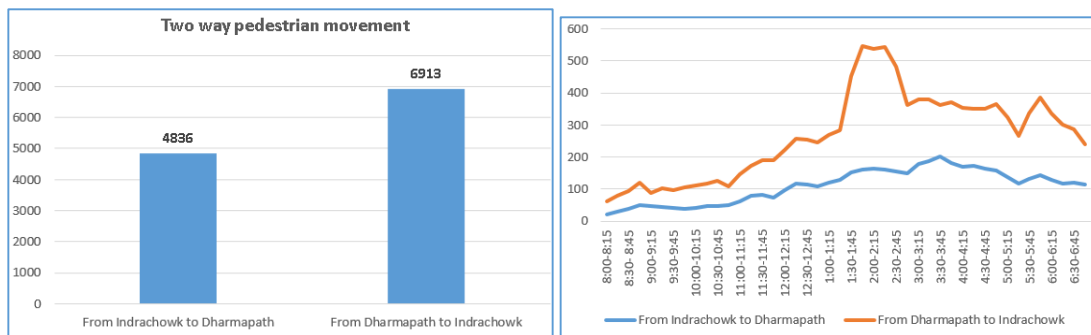


FIGURE 21: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

The trend of the direction of pedestrian movement also indicates the larger volume heading towards the Indrachowk sector i.e, 6913 compared to Dharmapath and beyond 4836

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

4. Pedestrian count Survey at Machhindra Bahal

TABLE 4: PEDESTRIAN COUNT DETAILS AT MACHHINDRA BAHAL

Direction:	From:Ason	From:Indrachowk	Total	Hourly
Along footpath	To:Indrachowk	To: Ason	Count	Count
Time Counted	No. of Pedestrian	No. of pedestrian		
8:00-8:15	208	185	393	
8:15-8:30	167	133	300	
8:30- 8:45	166	191	357	
8:45-9:00	143	136	279	1329
9:00-9:15	156	98	254	
9:15-9:30	131	152	283	
9:30-9:45	159	116	275	
9:45-10:00	184	126	310	1122
10:00-10:15	158	117	275	
10:15-10:30	183	118	301	
10:30-10:45	204	132	336	
10:45-11:00	198	127	325	1237
11:00-11:15	223	114	337	
11:15-11:30	212	139	351	
11:30-11:45	193	167	360	
11:45-12:00	219	181	400	1448
12:00-12:15	267	202	469	
12:15-12:30	302	221	523	
12:30-12:45	288	236	524	
12:45-1:00	293	265	558	2074
1:00-1:15	302	296	598	
1:15-1:30	295	336	631	
1:30-1:45	313	273	586	
1:45-2:00	336	283	619	2434
2:00-2:15	299	257	556	
2:15-2:30	320	262	582	
2:30-2:45	341	374	715	
2:45-3:00	328	317	645	2498
3:00-3:15	316	292	608	
3:15-3:30	320	274	594	
3:30-3:45	325	304	629	
3:45-4:00	259	326	585	2416
4:00-4:15	321	259	580	
4:15-4:30	250	208	458	
4:30-4:45	305	214	519	
4:45-5:00	263	257	520	2077
5:00-5:15	286	288	574	
5:15-5:30	262	287	549	
5:30-5:45	318	257	575	
5:45-6:00	312	307	619	2317
6:00-6:15	304	332	636	
6:15-6:30	261	291	552	
6:30-6:45	285	284	569	
6:45- 7:00	212	199	411	2168
Total	11187	9933	21120	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

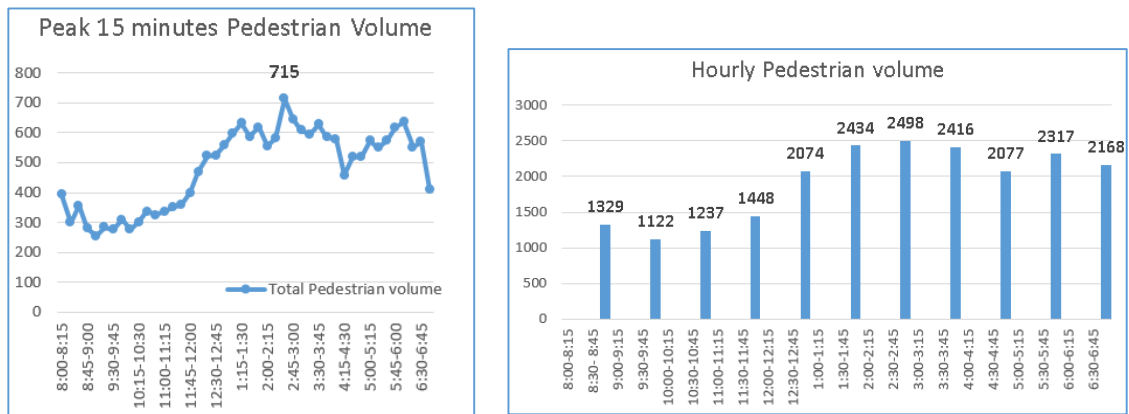


FIGURE 22: PEAK 15-MIN AND HOURLY COUNT

The peak 15 min pedestrian volume is 715 falling at the time interval of 2:30-2:45 hrs. However, the largest hourly pedestrian throughout occurs during 2:45-3:00 hrs with a volume of 2498 pedestrians.

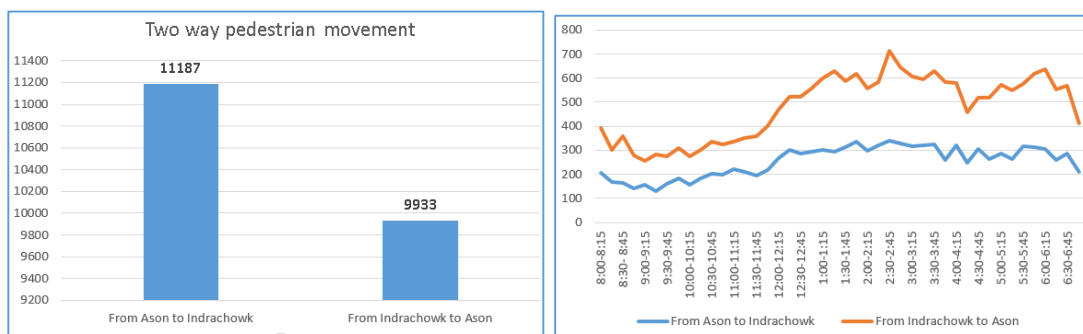


FIGURE 23: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

Further, it is evident from the data above that there are comparatively higher numbers of pedestrians passing from Ason to Indrachowk rather than those from Indrachowk to Ason.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

5. Pedestrian count Survey at Ugratara Mai Temple

TABLE 5; PEDESTRIAN COUNT DETAILS AT UGRATARA MAI TEMPLE

Direction:	From: Ason	From: Bagemuda	Total	Hourly
Along footpath	To: Bagemuda	To: Ason	Count	Count
Time Counted	No. of Pedestrian	No. of pedestrian		
8:00-8:15	67	122	189	
8:15-8:30	72	115	187	
8:30-8:45	82	124	206	
8:45-9:00	80	99	179	761
9:00-9:15	72	137	209	
9:15-9:30	89	176	265	
9:30-9:45	93	124	217	
9:45-10:00	85	157	242	933
10:00-10:15	103	158	261	
10:15-10:30	113	123	236	
10:30-10:45	159	105	264	
10:45-11:00	114	105	219	980
11:00-11:15	90	108	198	
11:15-11:30	103	123	226	
11:30-11:45	122	139	261	
11:45-12:00	131	167	298	983
12:00-12:15	153	160	313	
12:15-12:30	145	143	288	
12:30-12:45	168	136	304	
12:45-1:00	181	129	310	1215
1:00-1:15	166	112	278	
1:15-1:30	147	108	255	
1:30-1:45	142	124	266	
1:45-2:00	133	130	263	1062
2:00-2:15	189	147	336	
2:15-2:30	184	138	322	
2:30-2:45	175	125	300	
2:45-3:00	157	139	296	1254
3:00-3:15	155	128	283	
3:15-3:30	164	117	281	
3:30-3:45	130	192	322	
3:45-4:00	174	141	315	1201
4:00-4:15	224	179	403	
4:15-4:30	199	186	385	
4:30-4:45	166	189	355	
4:45-5:00	150	153	303	1446
5:00-5:15	182	185	367	
5:15-5:30	177	148	325	
5:30-5:45	186	158	344	
5:45-6:00	149	130	279	1315
6:00-6:15	224	187	411	
6:15-6:30	185	171	356	
6:30-6:45	265	176	441	
6:45-7:00	186	110	296	1504
Total	6431	6223	12654	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

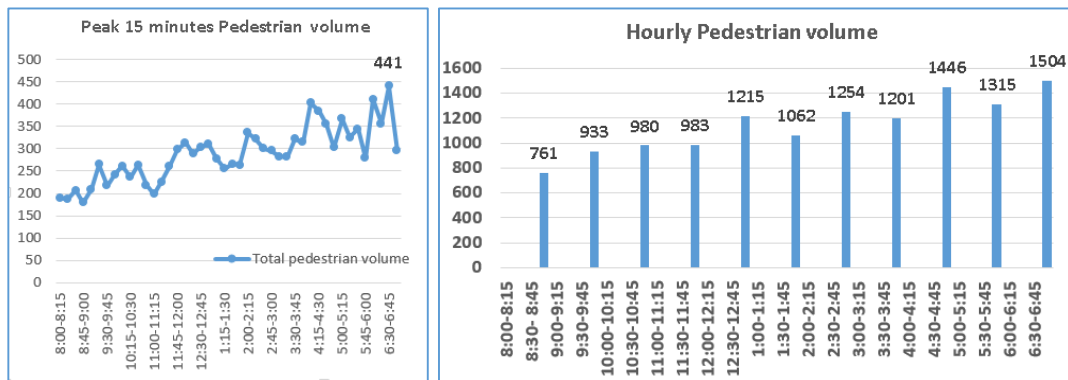


FIGURE 24: PEAK 15-MIN AND HOURLY COUNT

Although the 15 min. peak pedestrian flow occurs at the interval of 6:30-6:45 hrs and the pedestrian volume is 441. Eventually, the peak hourly traffic flow also falls from 6:00 to 7:00 hrs with the largest traffic volume of 1504.

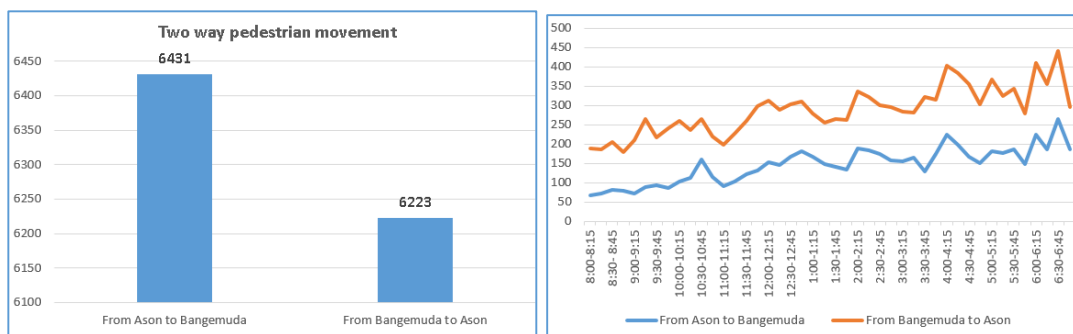


FIGURE 25: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

The trend of the direction of pedestrian movement also indicates the larger volume heading towards Bangemuda i.e, 6431 compared to Ason and beyond 6223.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

6. Pedestrian count Survey at Ganesh Temple

TABLE 6: PEDESTRIAN COUNT DETAILS AT GANESH TEMPLE

Direction: Along footpath Time Counted	From:Bangemuda To:Bhedasing No. of Pedestrian	From:Bhedasing To: Bangemuda No.of pedestrian	Total Count	Hourly Count
8:00-8:15	109	119	228	
8:15-8:30	103	90	193	
8:30- 8:45	75	76	151	
8:45-9:00	60	119	179	751
9:00-9:15	94	90	184	
9:15-9:30	110	116	226	
9:30-9:45	120	90	210	
9:45-10:00	181	87	268	888
10:00-10:15	148	78	226	
10:15-10:30	126	91	217	
10:30-10:45	116	91	207	
10:45-11:00	126	97	223	873
11:00-11:15	115	98	213	
11:15-11:30	113	90	203	
11:30-11:45	127	106	233	
11:45-12:00	132	98	230	879
12:00-12:15	151	109	260	
12:15-12:30	165	119	284	
12:30-12:45	157	142	299	
12:45-1:00	134	157	291	1134
1:00-1:15	149	148	297	
1:15-1:30	163	151	314	
1:30-1:45	148	133	281	
1:45-2:00	132	113	245	1137
2:00-2:15	150	146	296	
2:15-2:30	149	182	331	
2:30-2:45	141	155	296	
2:45-3:00	134	137	271	1194
3:00-3:15	122	87	209	
3:15-3:30	167	159	326	
3:30-3:45	137	133	270	
3:45-4:00	190	130	320	1125
4:00-4:15	189	147	336	
4:15-4:30	203	153	356	
4:30-4:45	238	145	383	
4:45-5:00	223	169	392	1467
5:00-5:15	217	182	399	
5:15-5:30	189	204	393	
5:30-5:45	174	192	366	
5:45-6:00	169	194	363	1521
6:00-6:15	184	175	359	
6:15-6:30	207	209	416	
6:30-6:45	142	251	393	
6:45- 7:00	170	269	439	1607
Total	6549	6027	12576	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

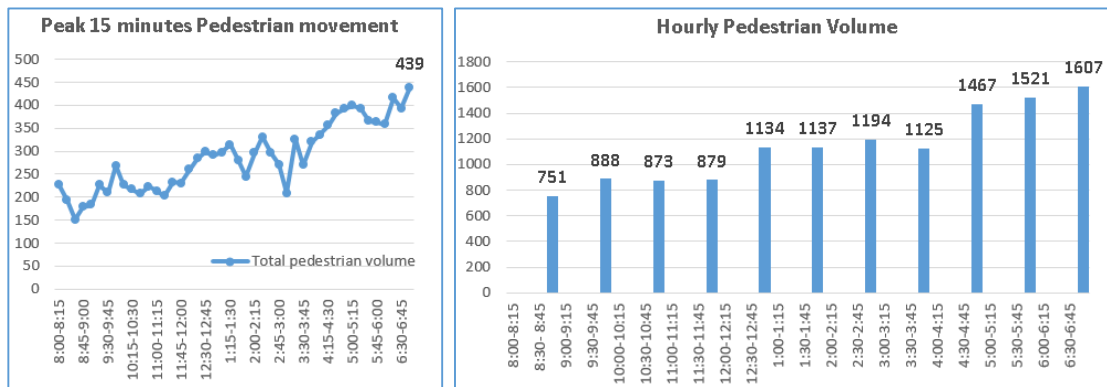


FIGURE 26: PEAK 15-MIN AND HOURLY COUNT

The peak 15 minutes of pedestrian traffic is 439 and the corresponding time interval is 6:45-7:00 hrs. The peak hourly pedestrian volume also falls on the same interval between 6:00-7:00 hrs with an aggregate pedestrian volume of 1607.

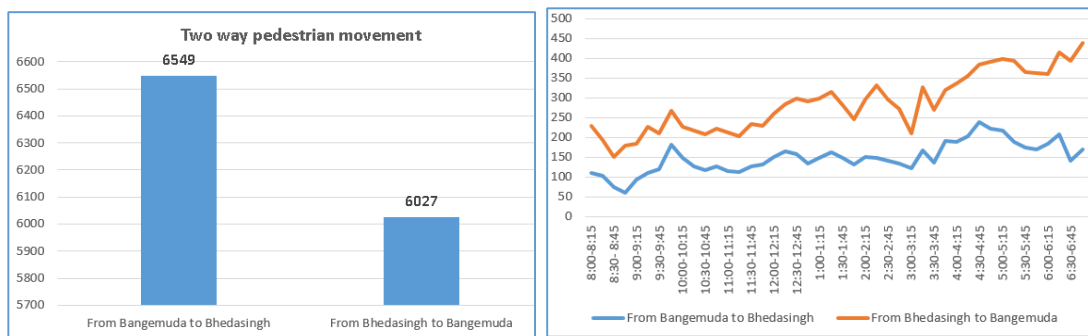


FIGURE 27: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

Further, it is evident from the data above that there is a comparatively higher number of pedestrians passing from Bangemuda to bhedasingh rather than those from Bhedasingh to Bangemuda.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

7. Pedestrian count Survey at Kilagal

TABLE 7: PEDESTRIAN COUNT DETAILS AT KILAGAL

Direction: Along footpath	From::Bhedasing To: Naradevi	From:Naradevi To: Bhedasing	Total Count	Hourly Count
Time Counted	No. of Pedestrian	No. of Pedestrian		
8:00-8:15	118	167	285	
8:15-8:30	126	158	284	
8:30- 8:45	154	149	303	
8:45-9:00	118	140	258	1130
9:00-9:15	124	128	252	
9:15-9:30	90	141	231	
9:30-9:45	121	162	283	
9:45-10:00	68	184	252	1018
10:00-10:15	96	165	261	
10:15-10:30	94	158	252	
10:30-10:45	83	115	198	
10:45-11:00	86	124	210	921
11:00-11:15	69	106	175	
11:15-11:30	137	126	263	
11:30-11:45	109	145	254	
11:45-12:00	128	121	249	941
12:00-12:15	126	155	281	
12:15-12:30	131	157	288	
12:30-12:45	122	138	260	
12:45-1:00	119	156	275	1104
1:00-1:15	121	178	299	
1:15-1:30	115	153	268	
1:30-1:45	106	138	244	
1:45-2:00	118	133	251	1062
2:00-2:15	129	141	270	
2:15-2:30	127	144	271	
2:30-2:45	135	142	277	
2:45-3:00	106	133	239	1057
3:00-3:15	108	113	221	
3:15-3:30	116	139	255	
3:30-3:45	149	213	362	
3:45-4:00	152	177	329	1167
4:00-4:15	150	121	271	
4:15-4:30	138	156	294	
4:30-4:45	142	143	285	
4:45-5:00	134	155	289	1139
5:00-5:15	156	161	317	
5:15-5:30	141	152	293	
5:30-5:45	165	139	304	
5:45-6:00	159	163	322	1236
6:00-6:15	177	181	358	
6:15-6:30	198	163	361	
6:30-6:45	222	129	351	
6:45- 7:00	241	150	391	1461
Total	5724	6512	12236	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

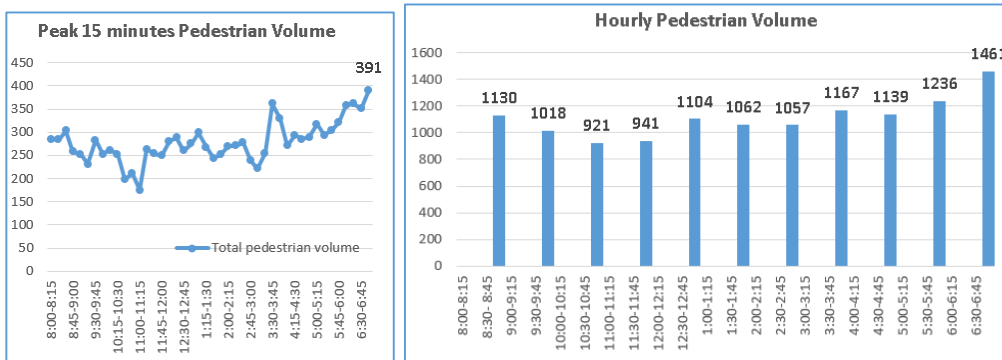


FIGURE 28: PEAK 15-MIN AND HOURLY COUNT

The peak 15 minutes of pedestrian traffic is 391 and the corresponding time interval is 6:45-7:00 hrs. The peak hourly pedestrian volume also falls on the same interval between 6:00-7:00 hrs with an aggregate pedestrian volume of 1461.

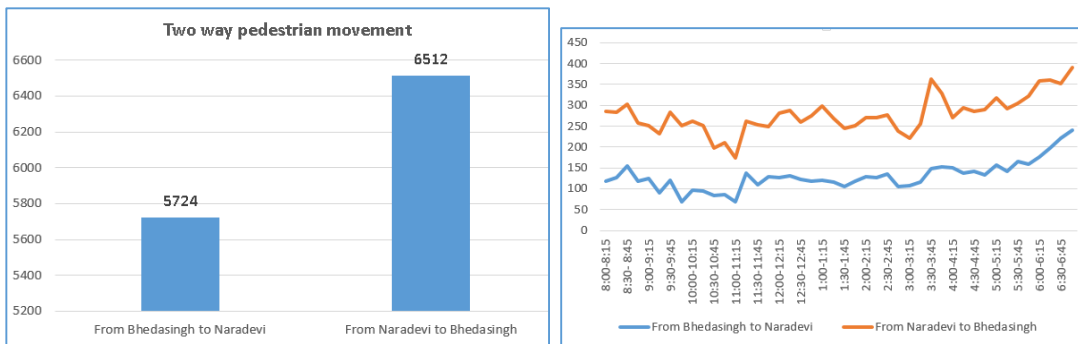


FIGURE 29: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

Further, it is evident from the data above that there are a comparatively higher number of pedestrians passing from Naradevi to Bhedasingh rather than those from Bhedasingh to Naradevi.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

8. Pedestrian count Survey at Shantaneshwor Mahadev Temple

TABLE 8: PEDESTRIAN COUNT DETAILS AT SHANTANESHWOR MAHADEV TEMPLE

Direction:	From:Naradevi	From:Basantapur	Total	Hourly
Along footpath	To:Basantapur	To:Naradevi	Count	Count
Time Counted	No. of Pedestrian	No. of pedestrian		
8:00-8:15	71	101	172	
8:15-8:30	92	92	184	
8:30- 8:45	69	42	111	
8:45-9:00	115	80	195	662
9:00-9:15	91	127	218	
9:15-9:30	95	121	216	
9:30-9:45	136	118	254	
9:45-10:00	155	127	282	970
10:00-10:15	113	107	220	
10:15-10:30	128	116	244	
10:30-10:45	121	113	234	
10:45-11:00	131	98	229	927
11:00-11:15	109	101	210	
11:15-11:30	97	111	208	
11:30-11:45	88	105	193	
11:45-12:00	100	119	219	830
12:00-12:15	107	102	209	
12:15-12:30	117	69	186	
12:30-12:45	121	73	194	
12:45-1:00	109	87	196	785
1:00-1:15	98	78	176	
1:15-1:30	67	55	122	
1:30-1:45	89	64	153	
1:45-2:00	97	76	173	624
2:00-2:15	114	69	183	
2:15-2:30	125	84	209	
2:30-2:45	129	90	219	
2:45-3:00	121	76	197	808
3:00-3:15	128	106	234	
3:15-3:30	101	91	192	
3:30-3:45	92	83	175	
3:45-4:00	80	69	149	750
4:00-4:15	102	114	216	
4:15-4:30	68	104	172	
4:30-4:45	100	103	203	
4:45-5:00	81	85	166	757
5:00-5:15	88	96	184	
5:15-5:30	104	121	225	
5:30-5:45	116	129	245	
5:45-6:00	152	98	250	904
6:00-6:15	147	103	250	
6:15-6:30	128	175	303	
6:30-6:45	129	166	295	
6:45- 7:00	126	158	284	1132
Total	4747	4402	9149	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

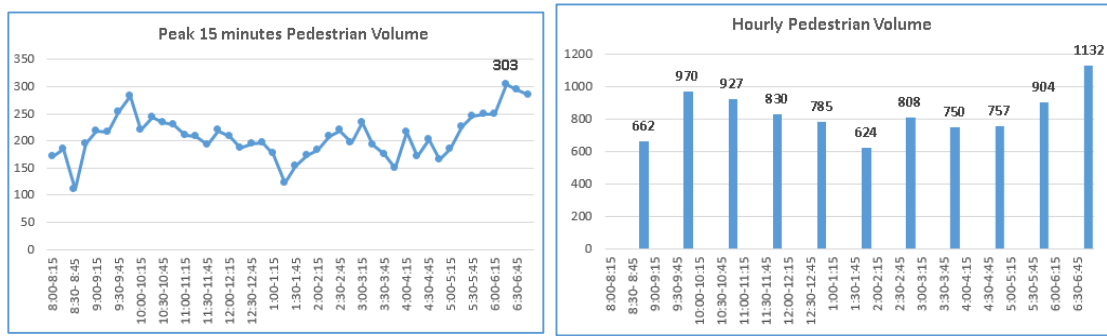


FIGURE 30: PEAK 15-MIN AND HOURLY COUNT

The peak 15 minutes of pedestrian traffic is 303 and the corresponding time interval is 6:15-6:30 hrs. The peak hourly pedestrian volume also falls on the same interval between 6:00-7:00 hrs with an aggregate pedestrian volume of 1132.

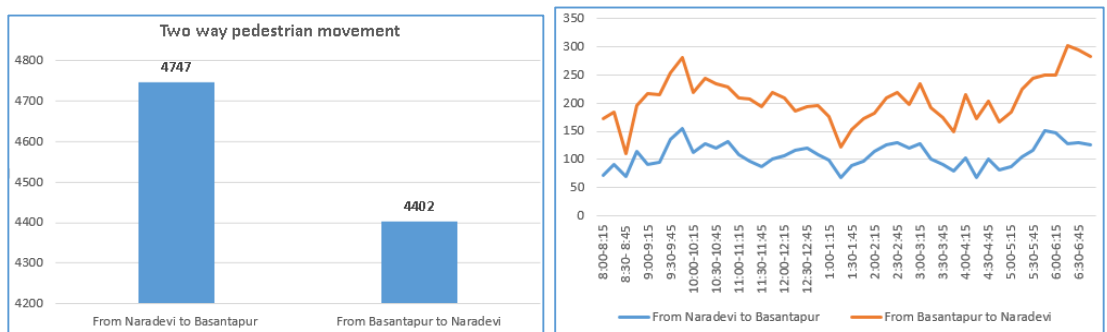


FIGURE 31: PEDESTRIAN VOLUME IN TWO WAY DIRECTION

Further, it is evident from the data above that there is a comparatively higher number of pedestrians passing from Naradevi to Basantapur rather than those from Basantapur to Naradevi.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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9. Pedestrian count Survey at Mahadev Temple

TABLE 9; PEDESTRIAN COUNT DETAILS AT MAHADEV TEMPLE

Direction: Along footpath	From: Basantapur To: Indrachowk	From: Indrachowk To: Basantapur	Total Count	Hourly Count
Time Counted	No. of Pedestrian	No. of Pedestrian		
8:00-8:15	277	198	475	
8:15-8:30	256	230	486	
8:30- 8:45	227	184	411	
8:45-9:00	244	169	413	1785
9:00-9:15	282	196	478	
9:15-9:30	308	179	487	
9:30-9:45	337	223	560	
9:45-10:00	228	153	381	1906
10:00-10:15	325	203	528	
10:15-10:30	263	177	440	
10:30-10:45	245	157	402	
10:45-11:00	236	142	378	1748
11:00-11:15	245	143	388	
11:15-11:30	156	209	365	
11:30-11:45	171	193	364	
11:45-12:00	163	215	378	1495
12:00-12:15	190	204	394	
12:15-12:30	187	196	383	
12:30-12:45	193	205	398	
12:45-1:00	189	188	377	1552
1:00-1:15	208	213	421	
1:15-1:30	281	254	535	
1:30-1:45	329	292	621	
1:45-2:00	312	277	589	2166
2:00-2:15	267	294	561	
2:15-2:30	229	319	548	
2:30-2:45	278	309	587	
2:45-3:00	314	331	645	2341
3:00-3:15	211	263	474	
3:15-3:30	236	277	513	
3:30-3:45	287	293	580	
3:45-4:00	182	254	436	2003
4:00-4:15	249	308	557	
4:15-4:30	238	316	554	
4:30-4:45	328	302	630	
4:45-5:00	252	301	553	2294
5:00-5:15	264	272	536	
5:15-5:30	288	275	563	
5:30-5:45	456	366	822	
5:45-6:00	289	373	662	2583
6:00-6:15	367	298	665	
6:15-6:30	351	283	634	
6:30-6:45	323	247	570	
6:45- 7:00	486	293	779	2648
Total	11747	10774	22521	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

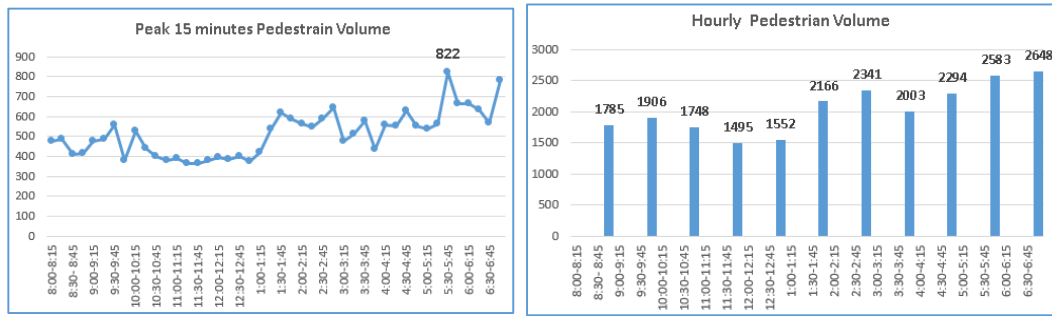


FIGURE 32: PEAK 15-MIN AND HOURLY COUNT

The peak 15 minutes pedestrian volume is 822 falling at the time interval of 5:30-5:45 hrs. However, the largest hourly pedestrian throughout occurs during 6:00-7:00 hrs with a volume of 2648 pedestrians.

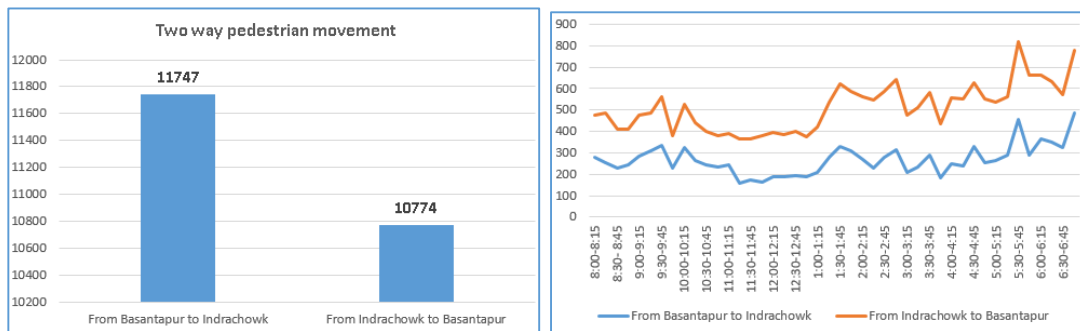


FIGURE 33; PEDESTRIAN VOLUME IN TWO WAY DIRECTION

The trend of the direction of pedestrian movement also indicates that there is a greater number of pedestrians moving towards Indrachowk from Basantapur(11747) than Basantapur from Indrachowk(10774).

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

6.2. Distribution of Pedestrian Volume

6.2.1. Total Pedestrian volume distribution around Kathmandu Durbar Square

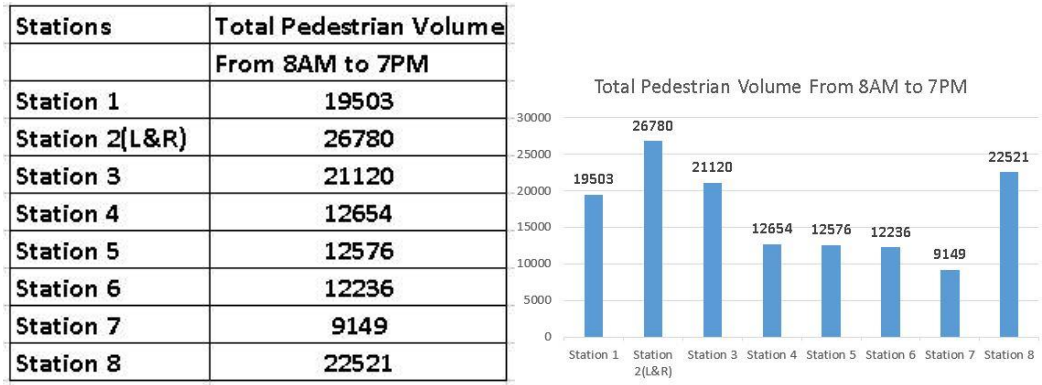
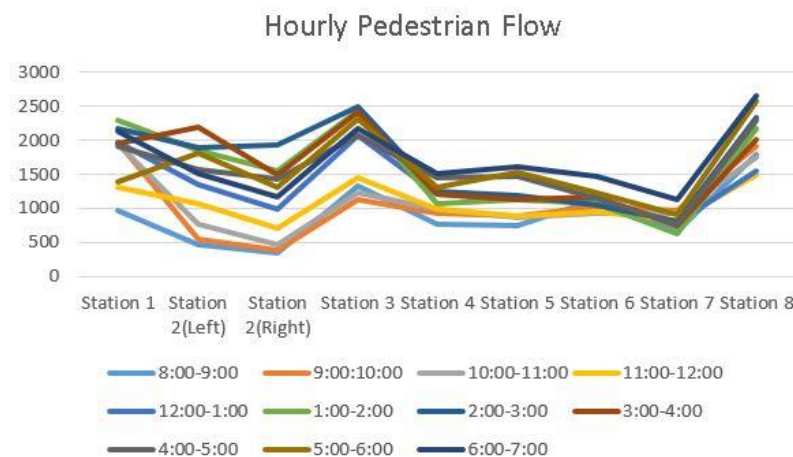


FIGURE 34: PEDESTRIAN THROUGHOUT

Station 2 (Shukrapath) has the highest amount of total pedestrians throughout during eleven hours period from 8 AM to 7 Pm and is followed by Station 8(Mahadev Temple), Station 3(Machhindra Bahal), station 1 (Basantapur Dabali), and the lowest one being station 7(Santaneshwor Mahadev Temple). However, the hourly distribution of pedestrian volumes around these locations can be asses using the following charts and graphs.



IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

Pedestrian Volume in Area around Kathmandu Durbar Square										
Time Interval	Station 1	Station 2(Left)	Station 2(Right)	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Total Count
8:00-9:00	972	467	353	1329	761	751	1130	662	1785	8210
9:00-10:00	1981	547	392	1122	933	888	1018	970	1906	9757
10:00-11:00	1942	759	461	1237	980	873	921	927	1748	9848
11:00-12:00	1303	1077	699	1448	983	879	941	830	1495	9655
12:00-1:00	1962	1346	979	2074	1215	1134	1104	785	1552	12151
1:00-2:00	2297	1861	1551	2434	1062	1137	1062	624	2166	14194
2:00-3:00	2168	1885	1924	2498	1254	1194	1057	808	2341	15129
3:00-4:00	1946	2195	1496	2416	1201	1125	1167	750	2003	14299
4:00-5:00	1902	1580	1420	2077	1446	1467	1139	757	2294	14082
5:00-6:00	1396	1809	1314	2317	1315	1521	1236	904	2583	14395
6:00-7:00	2138	1505	1160	2168	1504	1607	1461	1132	2648	15323
Total	20007	15031	11749	21120	12654	12576	12236	9149	22521	

FIGURE 35: HOURLY PEDESTRIAN THROUGHOUT

From these diagrams, it is evident that station 8(Mahadev Temple) along the Indrachowk-Basantapur segment has the highest pedestrian throughout followed by the pedestrian volume of station 3(Machhindra Bahal) along the Ason-Indrachowk segment.

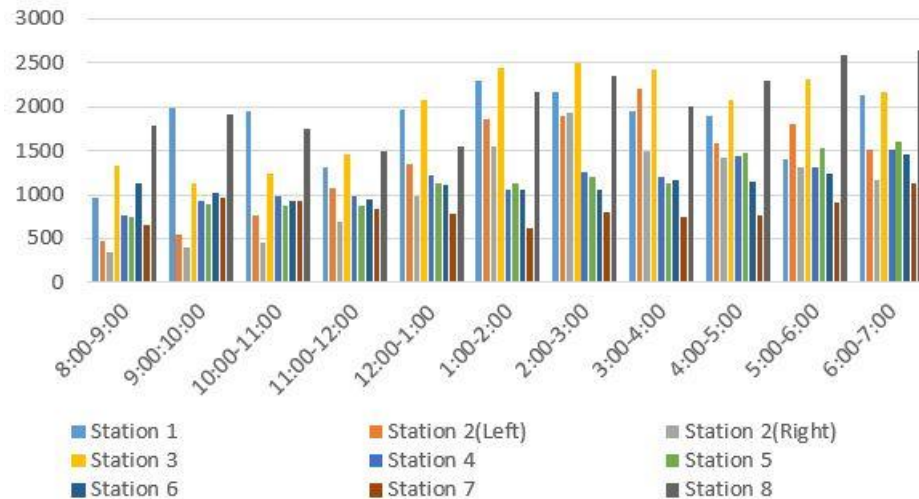


FIGURE 36: PEDESTRIAN THROUGHOUT AT STATIONS

6.2.2. Pedestrian volume distribution in each street

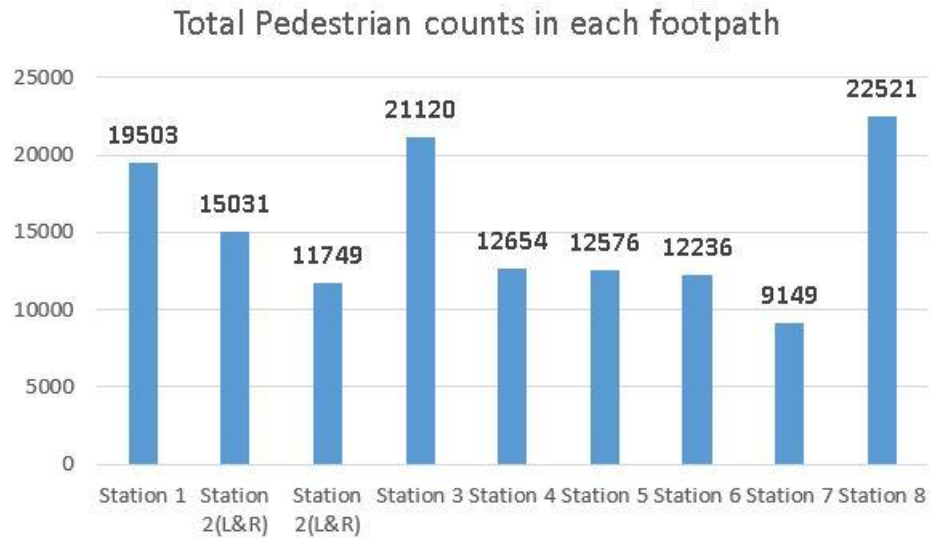


FIGURE 37: PEDESTRIAN DISTRIBUTION IN EACH STREET

It has been observed that total pedestrian volume in station 8 (Mahadev temple) along Basantapur-Indrachowk segment has the highest amount of pedestrian volume of 22521 followed by station 3 (Machhindra Bahal) along the Ason-Indrachowk segment. Hence, it is clear that in terms of land use, the religious area and shortcut diagonal route has the highest pedestrian throughout.

This is followed by the mixed commercial area like Ason which has a strong pedestrian volume.

6.2.3. Hourly Distribution of pedestrians on Streets

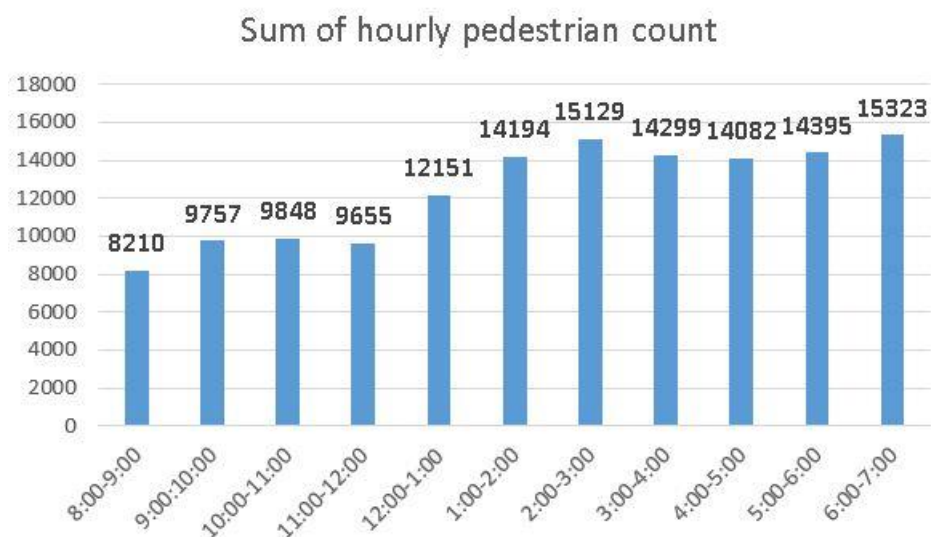


FIGURE 38: HOURLY PEDESTRIAN COUNT

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

The sum of hourly distribution of pedestrians is found to be the peak of 15323 during the time interval of 6 PM to 7 PM, which is strongly followed by the volume of 15129 during the time interval of 2 PM to 3 PM.

Hence, the peak hour pedestrian traffic is established as 6 PM to 7 PM. This is following the public survey where the pedestrian tending to return home from shopping was from 4 PM to 7 PM.

6.2.4. Peak 15 minutes pedestrian volume distribution

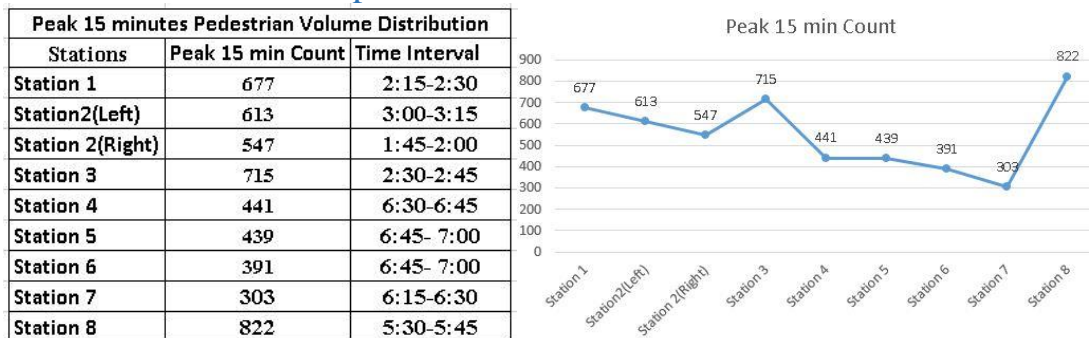


FIGURE 39: PEAK 15-MIN PEDESTRIAN DISTRIBUTION

According to the observation station, it has been identified that the highest 15-min pedestrian volume was at Station 8(Mahadev Temple) along the Basantapur-Indrachowk segment with a total pedestrian count of 822 whereas the lowest 15-min pedestrian volume was found to be at station 7(Santaneshwor Mahadev temple) along Naradevi-Basantapur segment.

6.3. Derivation of Pedestrian Flow Rates:

Pedestrian flow rate for the purpose has been derived on the unit of Pedestrian Volume per Minute per unit width of footpath.

$$\text{Pedestrian Flow Rate} = \text{pedestrian flow/minute/foot of footpath}$$

The per unit effective width of footpath is taken in feet as prescribed by Mr. J Fruin (1987).

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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6.4. Effective width of walkways and Assigning Level of Service of the pedestrian space:

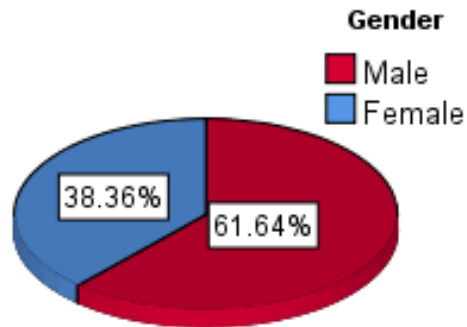
TABLE 10: EFFECTIVE WIDTH AND LOS EVALUATION OF WALKWAYS

Stations	Peak 15 minute Pedestrian Count	Total width of Walkway Space (Feet)	Effective width(Feet)	Flow rate(Pedestrian/Minute/Foot)	Level of Service(LOS)
Station 1	677	32	21	2.15	A
Station 2(L)	613	7	4	10.22	C
Station 2(R)	547	7	4	9.12	B
Station 3	715	20	13	3.67	A
Station 4	441	20	13	2.26	A
Station 5	439	18	15	1.95	A
Station 6	391	22	18	1.45	A
Station 7	303	15	10	2.02	A
Station 8	822	24	12	4.57	A

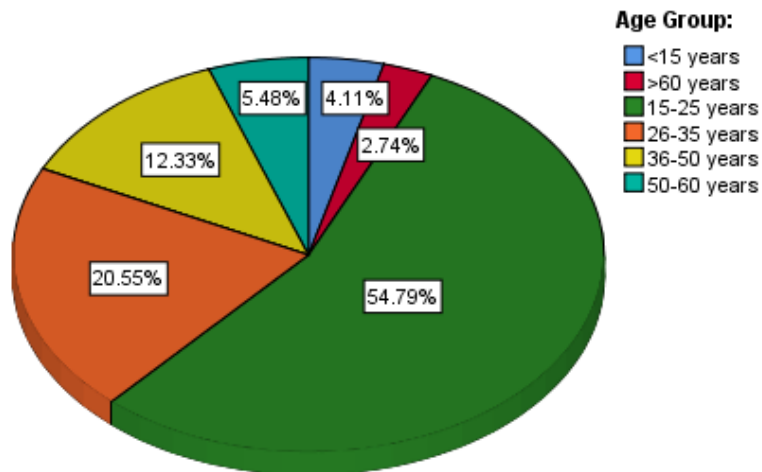
The flow rate of the pedestrians shows different result for the use of the street. Taking into account the effective width of the streets and the pedestrian volume, the mostly used street is Station 2L (10.22 p/ft/min) followed by Station 2R (9.12), Station 8 (4.57), Station 3 (3.67), Station 4 (2.26), Station 1 (2.15), Station 7 (2.02), Station 5 (1.95) and Station 6 (1.45).

6.5. Pedestrians Survey Data Analysis

A questionnaire survey was conducted on 73 people walking on the streets of the study area. Diverse populations according to gender and age group were selected at different times of the day for a survey. Among the surveyed population, 61.64% were male and 38.36 % were female.

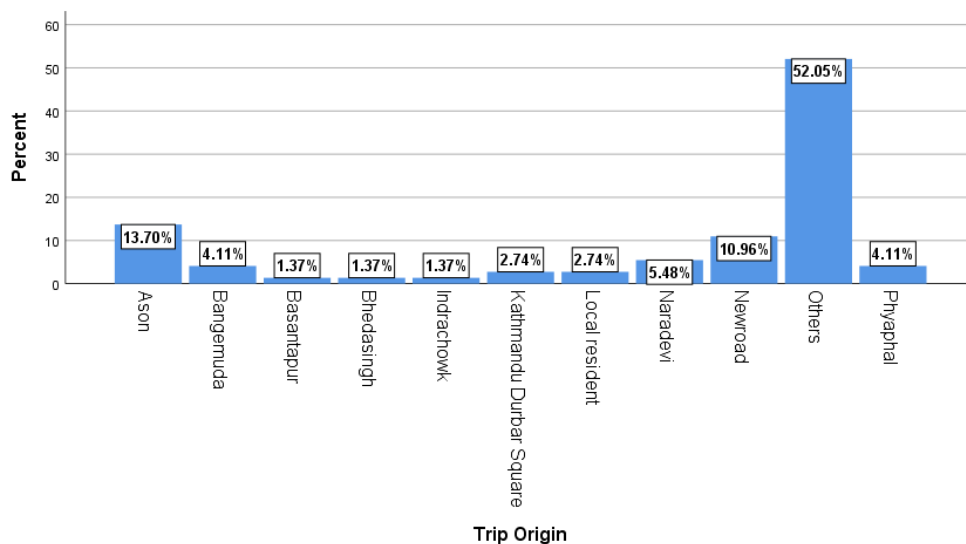
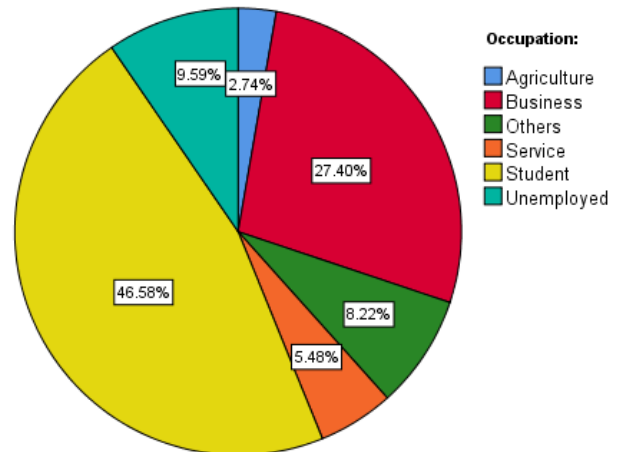


4.11% were less than 15 years of age, 54.79% were of the age group 15-25, 20.55% were of age group 26-35, 12.33% were of age group 36-50, 5.48% were of age group 50-60 and 2.74% were greater than 60 years of age. It was found that most of the people that use pedestrian transport are of age 15-35 years of age.



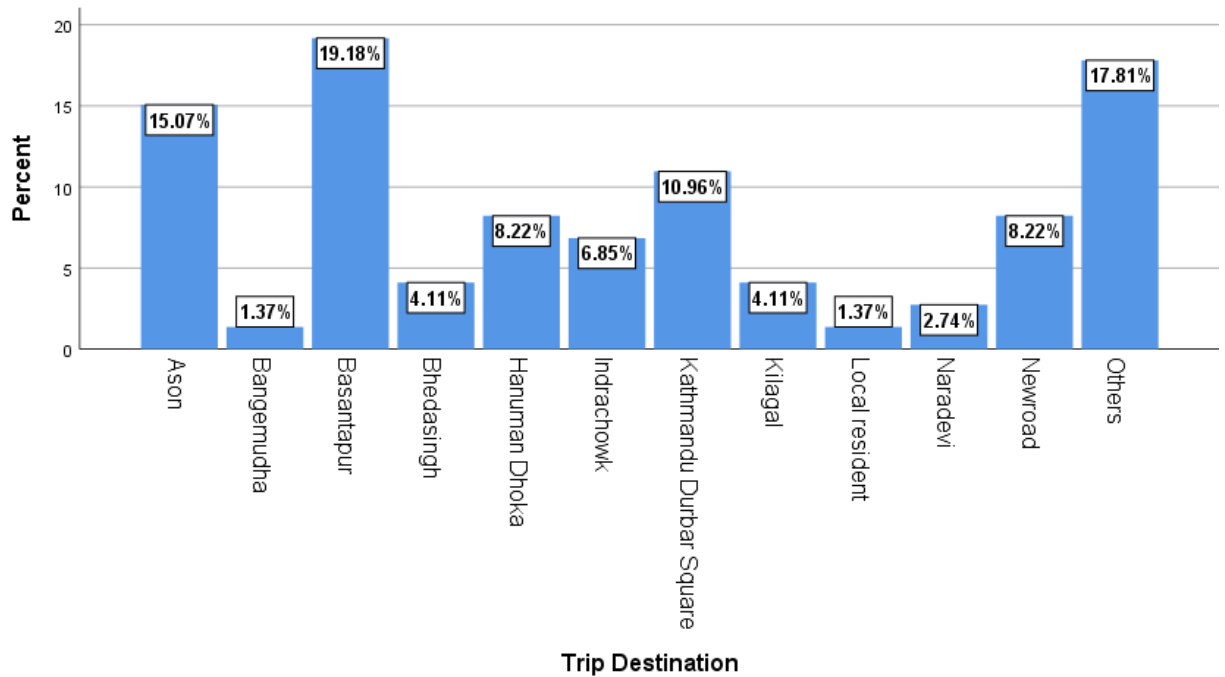
IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

According to the survey, it was found that most of the pedestrians were students. 27.4 % of the pedestrians were businessmen. 9.59% were unemployed and 8.22% were others.



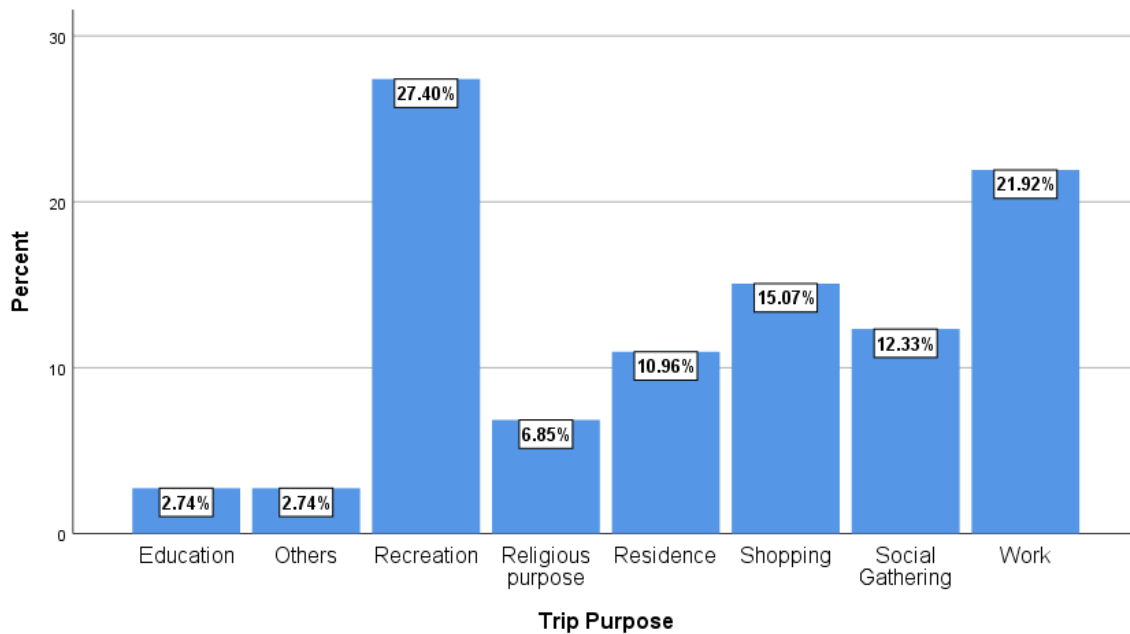
Origin- destination survey showed that the origin of the pedestrians was mostly from other areas followed by Ason. The other areas of origin include Newroad, Naradevi, Bangemuda, and Phyaphal. People have been found to walk from other areas outside Kathmandu. Major origin points are on the northern side of the study area.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU



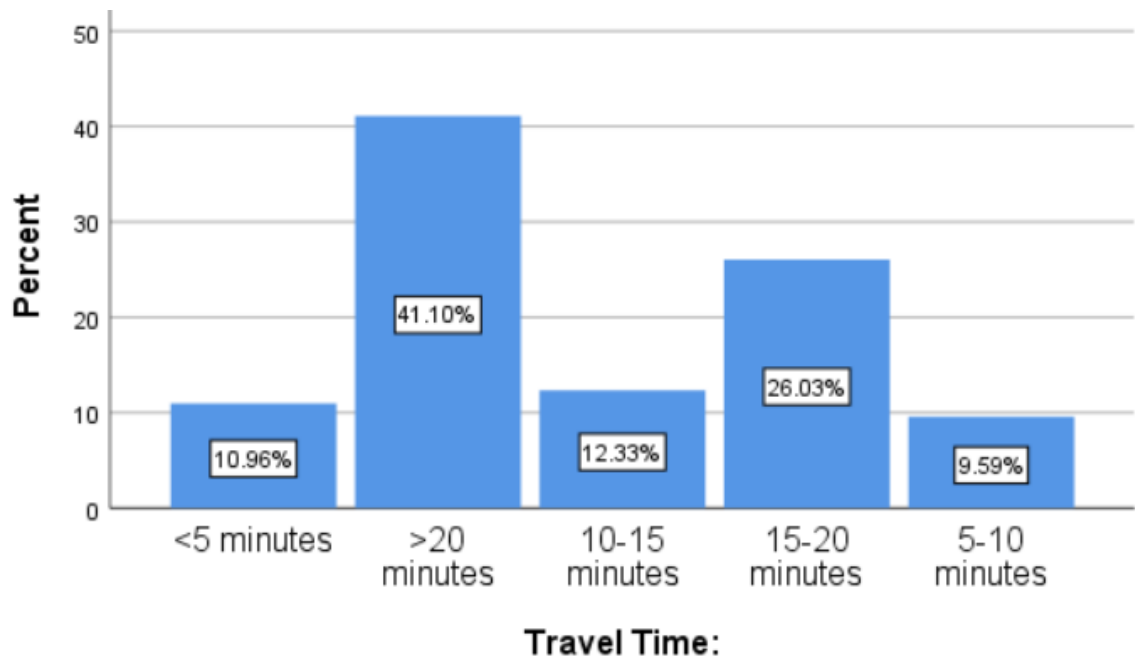
Origin- destination survey showed that the destination of the pedestrians was mostly Basantapur followed by other areas. The other areas of destination include Ason, Kathmandu Durbar square, Hanuman Dhoka, New road, Indrachowk, Bhedasingh, Kilagal, and Naradevi. Destination of pedestrians was mostly around Kathmandu Durbar Square area but people have also been found to walk towards other areas outside Kathmandu Durbar square. The major destination points have also been found to be on the southern side of the study area.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

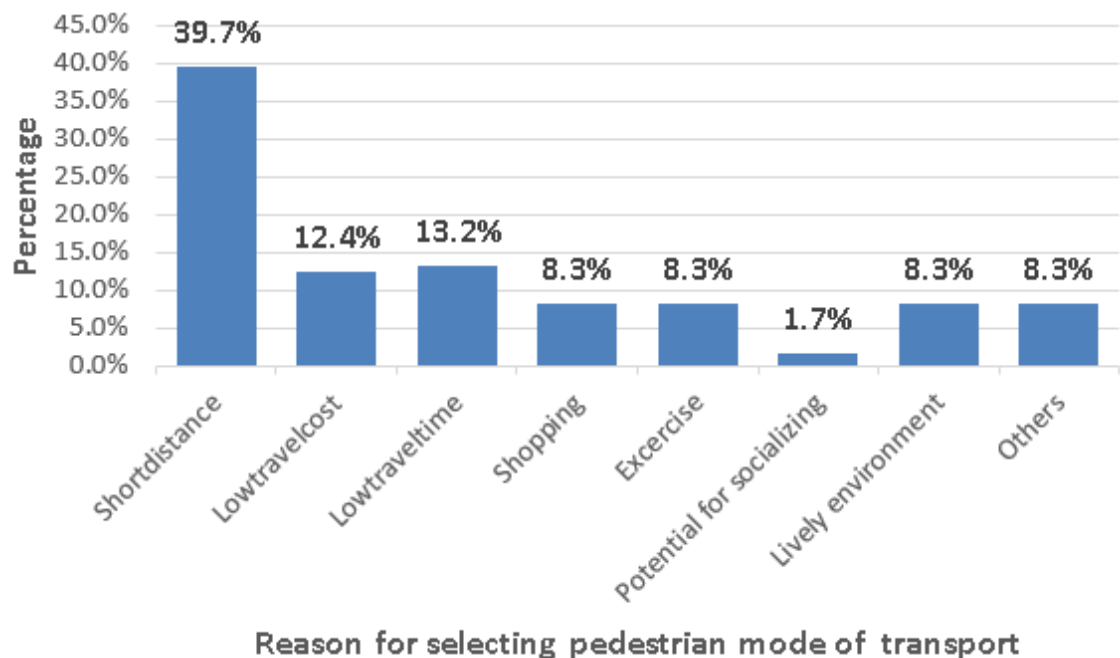


The purpose of the trip for the pedestrians was found to be mostly for recreation purposes. Proximity to Kathmandu Durbar Square has made recreation a major trip purpose for the people going through this area. The other main trip purposes include work, shopping, and social gathering. There are some shops and offices in this area that have created job opportunities for the people. As the area is a commercial area, shopping is likely a major trip purpose for the people. The other trip purposes are residence, religious purposes, educations. Since there are several religious monuments on the way like Degutaleju temple, Shree Kaalbhairav temple, and Kageshwor Mahadev temple, people are found to travel this road because of religious faiths and beliefs.

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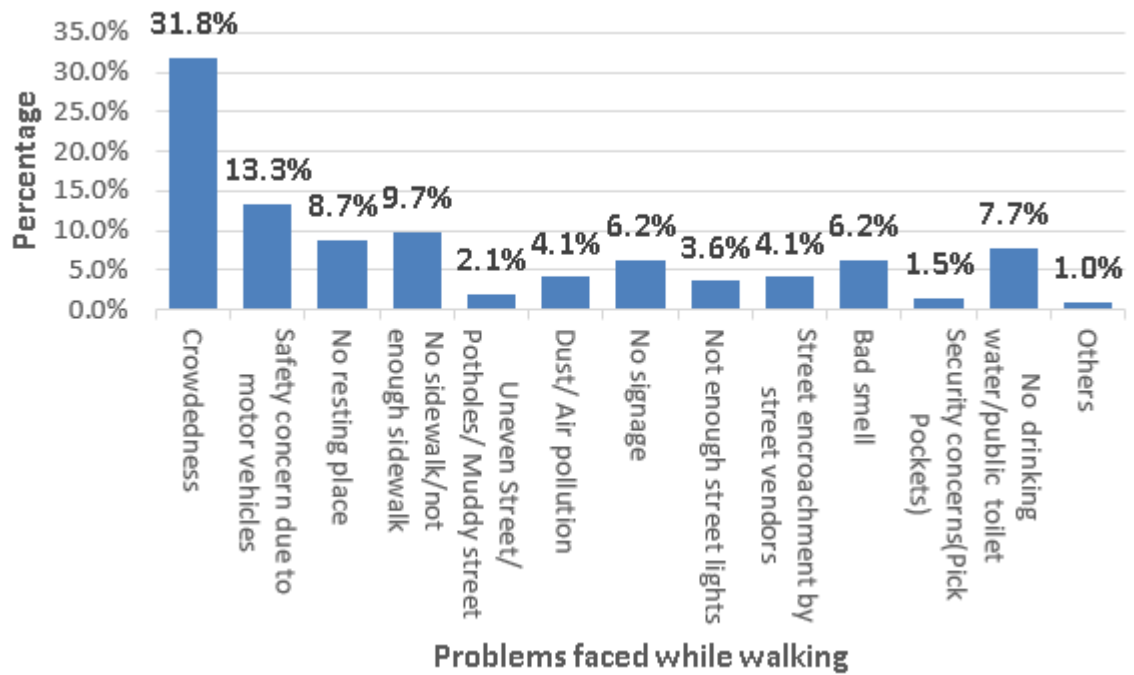


For most of the pedestrian, time travel greater than 20 minutes is 41.1% and time travel 15-20 minute is 26.03 %.

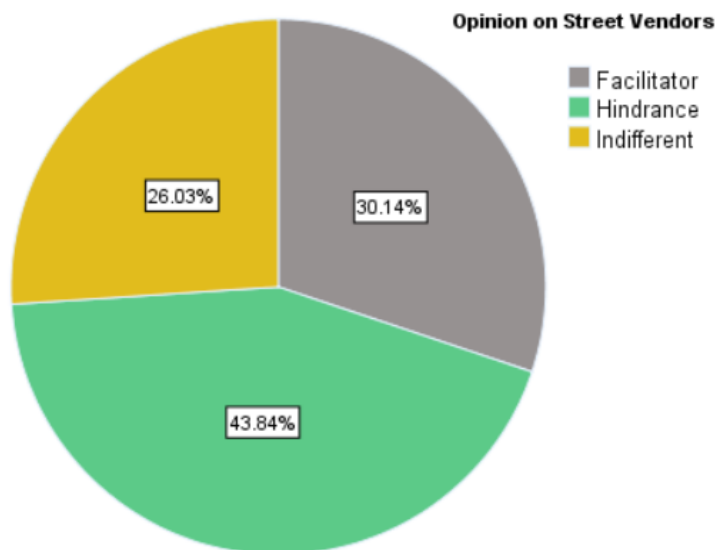


Most of the reason for selecting pedestrian mode of transport is short distance (39.7%).

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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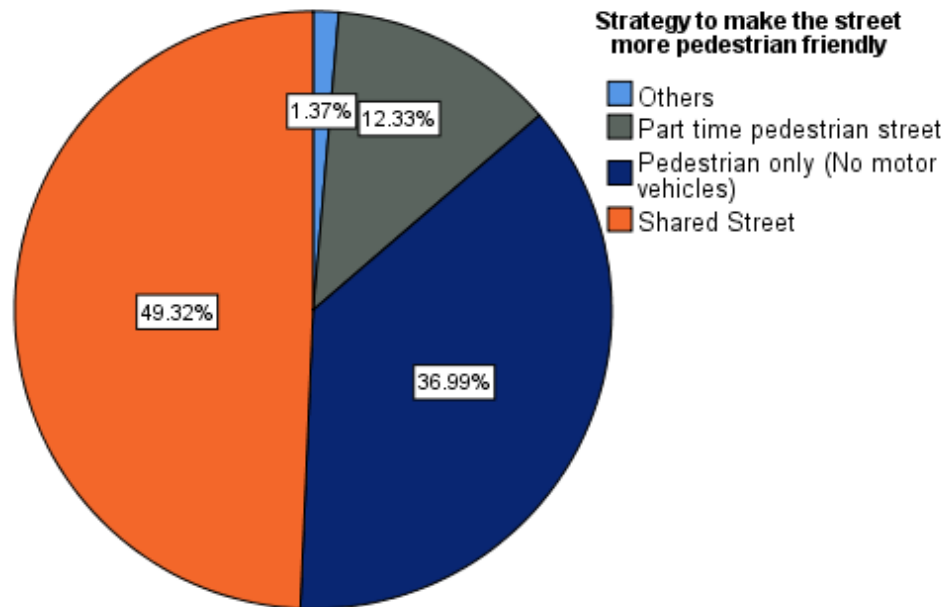


Most of the problems faced while walking is crowdedness which is 31.8% followed by motor vehicle, safety concern due to motor vehicles, no side walk, no resting place. Other problems are no signage, not enough street lights, bad smell and so on.



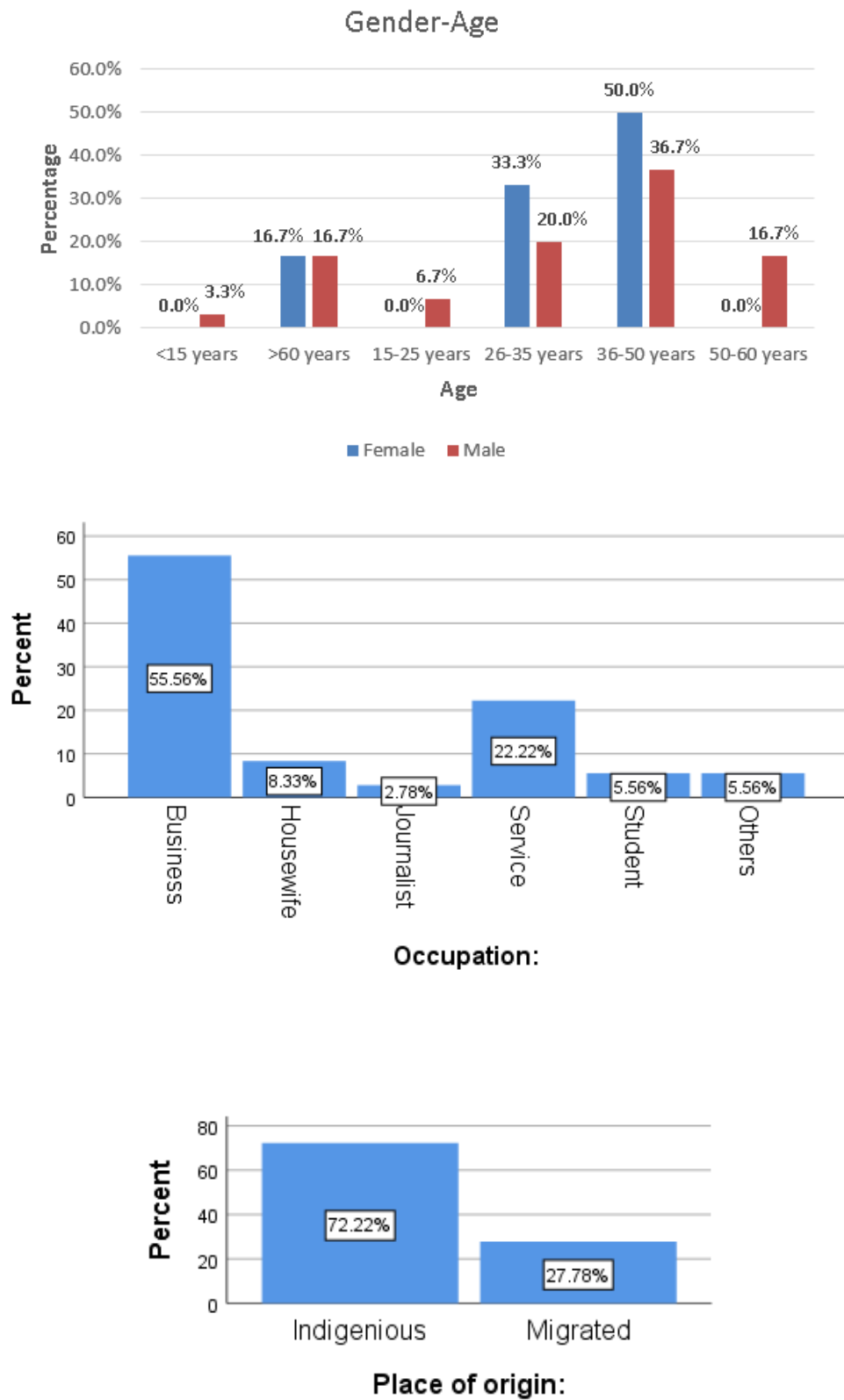
43.84% of the surveyed pedestrians thought that the street vendors were a hindrance to them and 30.14% considered the street vendors to be a facilitator. And 26.03% are indifferent about the street vendors.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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Most of the surveyed pedestrians preferred shared street. 49.32% preferred shared street. 36.99% preferred pedestrian only (no motor vehicles).

6.6. Residents Survey Data Analysis



6.7. Evaluating Urban Form

6.7.1. Streets and Sidewalks

The streets of Kilagal, Bhedasing, Indrachowk, and Makkhan are stone-paved with street width varying from 12'-25'. The streets at Makkhan and Kilagal are comparatively wide. The streets of Phyaphal are blacktopped with street width varying from 10'-15'. There is no sidewalk in any of these streets despite the heavy pedestrian flow and heavy speed two, three, and four-wheelers including the carts and rickshaws.



FIGURE 40: ROAD SURFACE

The streets of Makkhan are in good shape as it is a highly commercial area with supermarkets. The streets are stone-paved and in a quite good condition without potholes. The streets of Bhedasing and kilagal are also paved but with slippery stones. These streets are quite dangerous for the pedestrian and vehicles due to widespread prevalence of potholes and wrecked pavements. At the junction of Bhedasing Chowk and Kilagal, the wrecked pavements have made the condition of the street much critical.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

Indrachowk, being the rickshaw stand and junction of five streets, one can observe lots of potholes and broken pavements creating havoc for pedestrians.

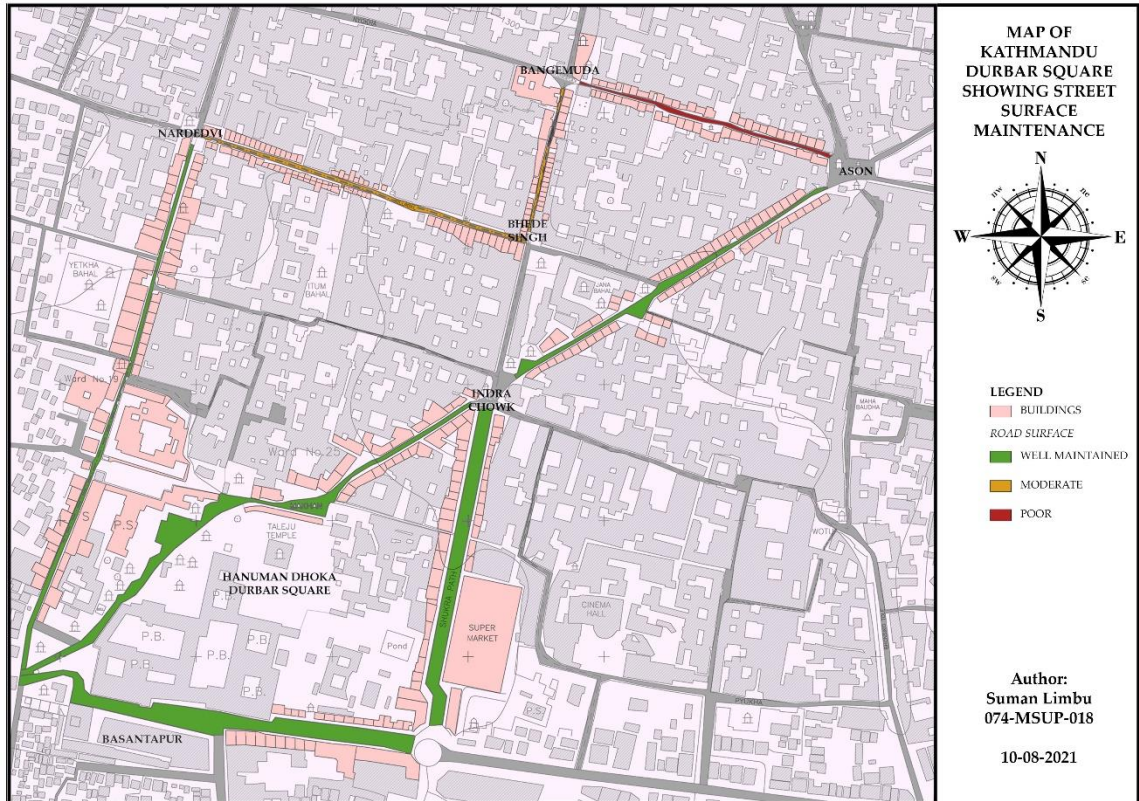


FIGURE 41: STREET CONDITION

The condition of the street is very poor in Phyaphal. The street is blacktopped with lots of potholes. In many places, the black topped has been damaged leaving a muddy road. Hence, the lack of maintenance can be seen in this street. Both sides of the street are provided with drains but are not functioning properly.

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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TABLE 11: CONDITION OF STREETS AT URBAN CORE

SN	Street	Street width	Street pavement	Street condition	Sidewalk	Potholes
1	Makkhan	12'-24'	Stone paved	Good	No	No
2	Indrachowk	13'-20'	Stone paved	Medium	No	Yes
3	Bhedasingh	15'-18'	Stone paved	Medium	No	Yes
4	Kilagal	18-22'	Stone paved	Medium	No	Yes
5	Phyaphal	10'-15'	Stone paved	Medium	No	Yes

6.7.2. Building heights and Building façade

Due to being an ancient densely populated residential area located close to Kathmandu Durbar Square, most of the buildings here are with façade of brick. Changes can be seen, however, in terms of building façade use of construction material, building height, and use of building itself owing to modernization.

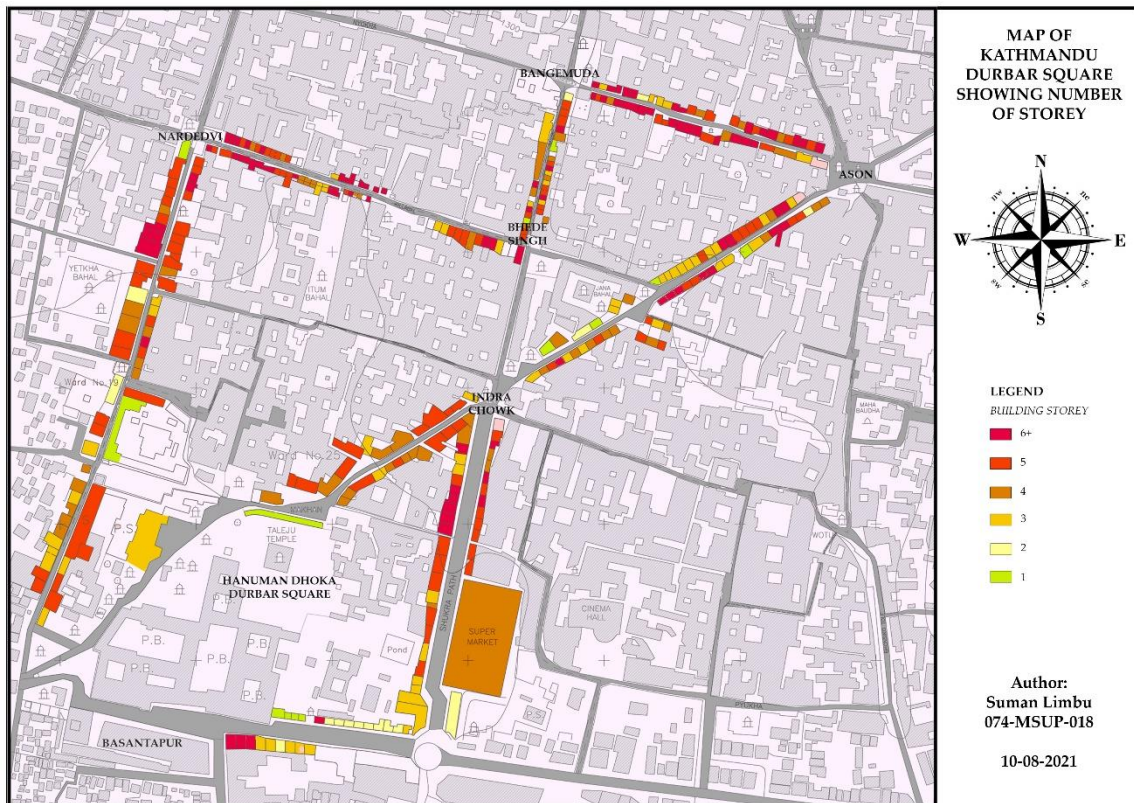


FIGURE 42: BUILDING STOREY

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

Makkhan, being a highly commercial area which, directly leads to Kathmandu Durbar Square comprises a unique blend of traditional, neoclassical, and modern buildings with cement plaster or brick exposed façade. Buildings are mostly 4-7 storied with some buildings up to 8 stories. The majority of the buildings are directly attached to the street due to having no sidewalks; some are separated by the steps and plinth of the buildings. All the ground floors are used as shops while the upper floor of most buildings is also used for commercial purposes and only the uppermost floors are used for residential purposes.

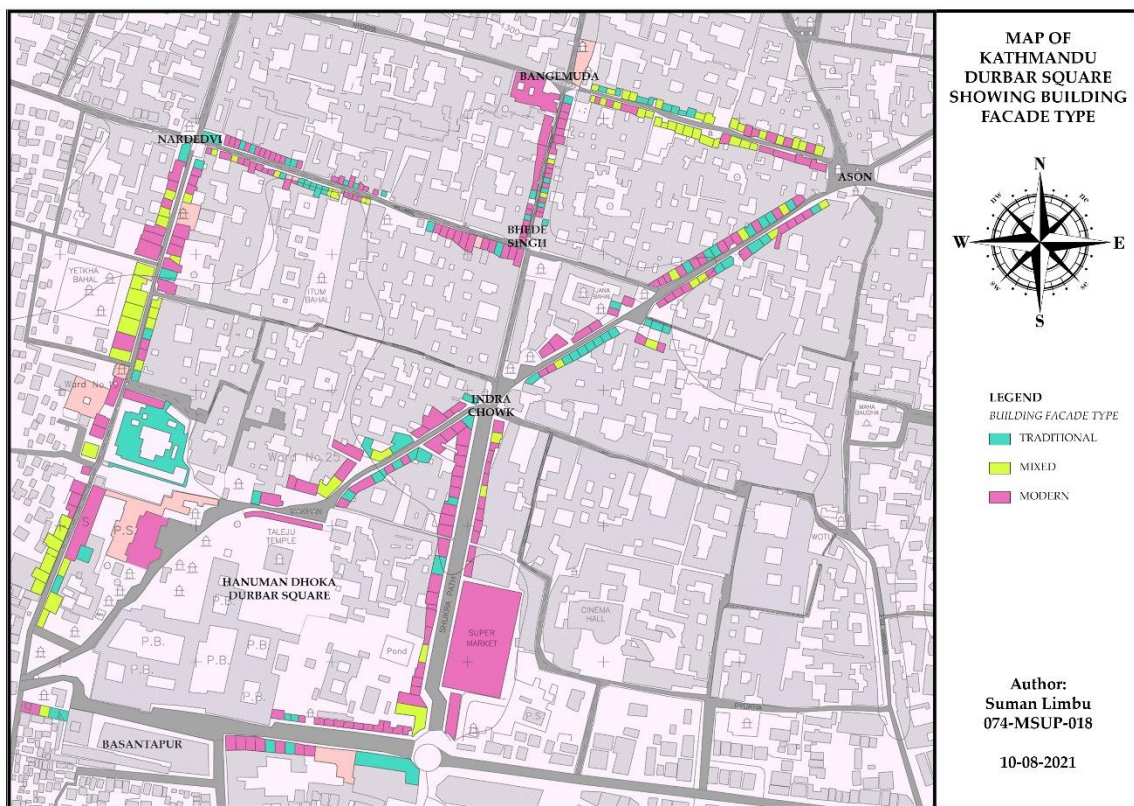


FIGURE 43: BUILDING FACADE TYPE

Similarly, one can also observe a blend of traditional, neoclassical, and modern 5-8 storied buildings with façade of brick and cement plaster with use of GF as shop in Indrachowk and Bhedasingh.

Along the street of Kilagal, building varies from 4-8 stories and also consist of building of traditional, neoclassical and modern types. Most buildings that are used as residential accept the use of GF for commercial purposes. Some buildings are in a dilapidated state.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM: A CASE OF HISTORIC CORE AREA OF KATHMANDU

Along the street of Phyaphal, buildings are normally 4 and 5 storied but few buildings are 6-7 storied. Modern buildings with ACP panels on the façade can also be seen on the street of Phyaphal.

Except for the steps, buildings are directly attached to the streets due to the lack of pedestrian sidewalks.

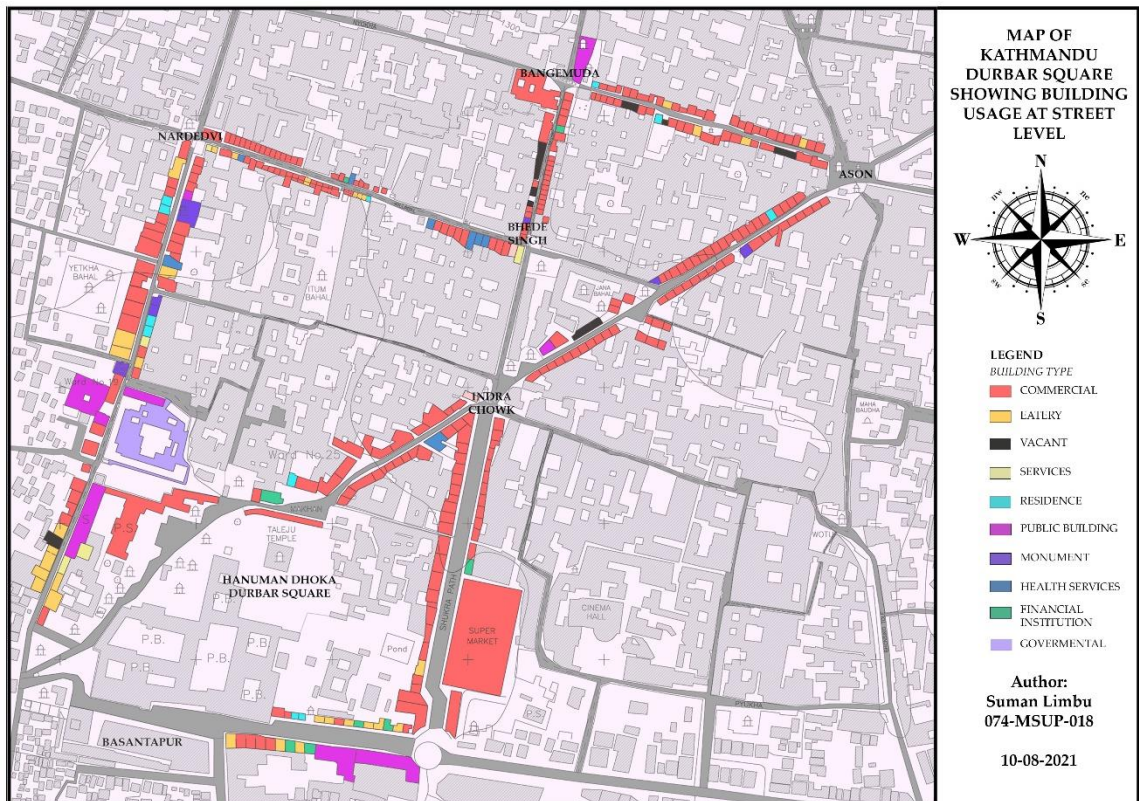


FIGURE 44: BUILDING TYPE IN STUDY AREA

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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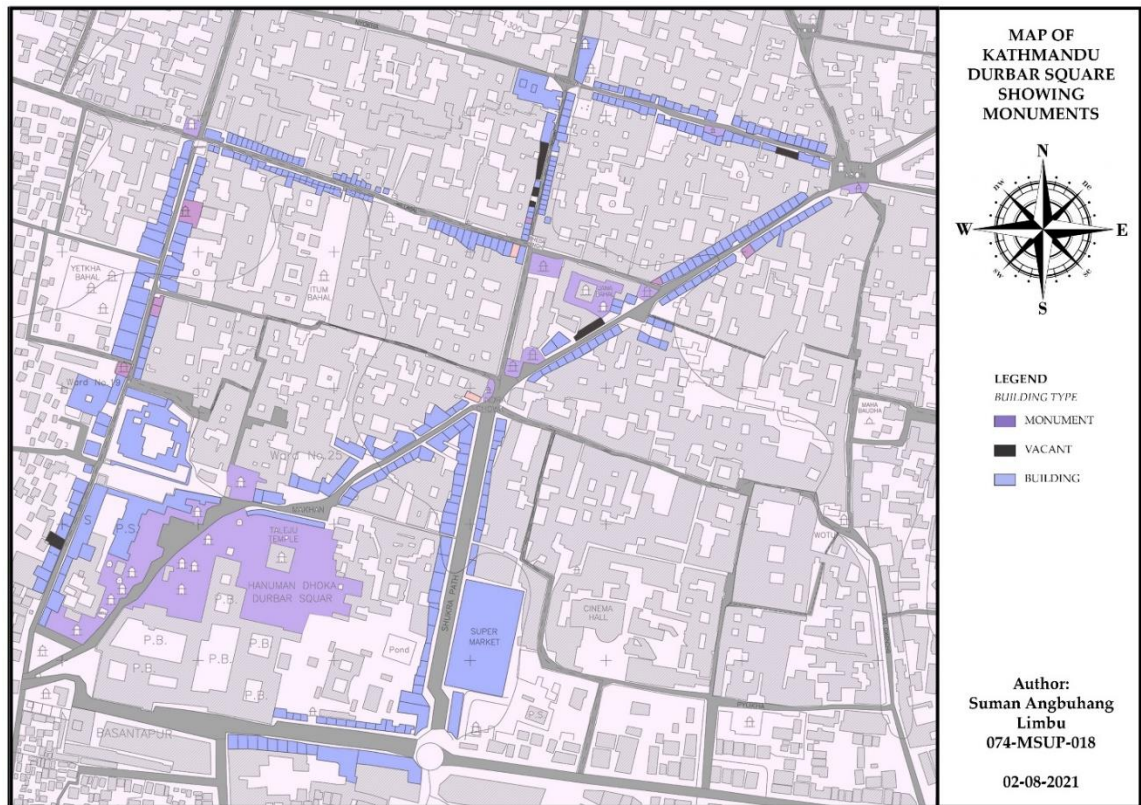


FIGURE 45: BUILDING TYPE

TABLE 12: CONDITION OF EXISTING BUILDINGS AT THE URBAN CORE

SN	Street	Building Storey	Building Facade	Ground Floor Use	Building Type	Distance of street from the building
1	Makkhan	4-8 story	Brick exposed, cement plaster	Shops	Residential and commercial	Attached
2	Indrachowk	4-8 story	Brick exposed, cement plaster	Shops	Residential and commercial	Attached

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3	Bhedasing	5-8 story	Brick exposed, cement plaster, neoclassical	Shops	Residential and commercial	Attached
4	Kilagal	1-8 story	Brick exposed, cement plaster, neoclassical	Shops	Residential	Attached
5	Phyaphal	2-8 story	Brick exposed, cement plaster, neoclassical	Shops	Residential	Attached

6.7.3. Open Space

Being the urban core and traditional Malla town of Kathmandu Valley, the settlement was based on a courtyard system. Today those traditional courtyards are the open space in the locality. Two large open spaces are observed in the study area. One is Yatkha bahal in Phyaphal and the other is Itumbahal at kilagal. These open spaces are linked to the street through narrow alleys. Today these spaces are used for various purposes: children for playing, adults for idling their time, and others for parking bikes and many other activities.

6.7.4. Parking facilities

There are no defined parking facilities for two and four-wheelers due to the lack of sufficient open spaces. The small open space at the Bhedasing chowk which was previously the public water tap and the corner space at Phyaphal are being used for parking during the morning and evening peak hours. At Makkhan, the space at the front of Suraj arcade, the commercial building, is being used for parking bikes.

6.7.5. Street Furniture

Street lighting can be seen hardly at the nodes. Between the nodes, there are very few street lightings placed at uneven distances. Many of them have not functioned fixtures while some have no fixtures at all. Currently, with the effort of the local club, CFL bulbs have been provided at different locations. According to Mr. Chaitya Narayan Maharjan, a member of the local club, they are sending a request letter to KMC for solar light in that area.

6.7.5.1. Street benches and seats

Temples are located at every junctions and node of Makkhan, Indrachowk, Bhedasing, Kilagal, and Phyaphal. The plinths of temples are religious entities and part of the temple. The plinth and the open platform though were not designed for the public to sit and rest; they were used in the past for resting and they continue to be used for the same even at present.

The plinth of the temples has been the resting space for the pedestrians to some extent. Most of the plinth is heavily occupied by vendors to run their business. The backside of the shiva temple at the Bhedasing temple is heavily occupied by the local shopkeepers to store their materials. The plinths at Indrachowk are occupied by vendors as clothes shops.

Patis, which were the seating and resting place in the past, can be seen at kilagal street but are on the verge of deterioration due to negligence, and currently, they serve very little purpose.

6.7.5.2. Signage and Dustbins

Signage to guide pedestrians can be seen at some locations but they are in a pathetic state at improper places such that pedestrians can barely notice them.

Dustbins and litter boxes are not seen in these streets; instead vendors, locals and pedestrians throw the garbage at street corners which are then collected daily in the morning by the municipality.

6.7.5.3. Public toilet and drinking water supply

There is no provision for a public toilet and water supply system for pedestrians, therefore, local vendors and pedestrians have to go to local shops and restaurants for the same.

6.7.5.4. Cleanliness

The streets of the kilagal and Bhedasing are one of the main vegetable markets areas after Ason chowk.

So, despite a regular collection of solid waste by the municipality, there always remains vegetable garbage littered at many places. So, the environment is mostly untidy. This is more problematic during rainy days when the streets become muddy by them creating discomfort for the pedestrians.

The streets of Makkhan and Indrachowk mainly consist of scraps of paper, plastic bags, etc making the environment unsightly.

Similarly, Phyaphal is in no good state. The streets are in poor condition with a poor drainage system and the roads are mostly muddy.

6.7.5.5. Bus stand

Within these streets, there are no buses and micro stands. People have to go to NAC, Bhotahity, Jamal, or Ratnapark to catch their bus or automobile in the east and Dallu in the west.

6.8. Evaluating the Existing Urban Design Qualities

6.8.1. Interesting elements and temples at every node

Nodes are the strategic junctions characterized by the intensity of the activities in that area. They are the focal points that attract public activities because of their location or the existence of remarkable elements.

Being the urban core of Kathmandu and one of the very compact traditional settlements of the Malla town, the streets of Phyaphal, Kilagal, Bhedasing, Indrachowk, and Makkhan are comprised of temples and open platforms at every node. At the node of Phyaphal and kilagal, there is a very popular Akash Bhairab temple, Makkhan and Phyaphal Street directly lead to the Basantapur Durbar Square.

Besides the location of temples at every node, temples can also be found at the phyapal road stretch and kilagal. All the temples are of high architectural value representing our traditional Malla architecture.

Due to the presence of these temples, one can experience dramatic change at every node. There is no monotony along the streets since these temples in the streetscape break the continuity of the residential buildings.

The interesting streetscape along with dramatic changes at every node and along the street itself is the cause for most of the touristy to walk in these streets.

6.8.2. Existence of traditional and neo-classical buildings

Along these streets of the study area still comprises traditional Newari buildings with high artistic doors and windows. One of the very artistic windows known as desemadu jhya is also located on the street of Phyapal. Besides this, the traditional and artistic Dyochhen is also present in these streets. The numbers of neoclassical buildings are significant in these streets. The majority of buildings are still of residential use.

These traditional Newari buildings with high artistic window carvings representing the rich architecture of our country are also the major attractions of these streets inviting maximum flow of people to walk in these streets.

But lack of proper care and maintenance can be seen in the case of these traditional buildings.

6.8.3. Most vibrant and lively place

One of the major urban design qualities is the liveliness of the place. Being close to the traditional business and market center Ason and one of the heritage sites, Kathmandu Durbar Square, the streets are always vibrant due to the heavy flow of pedestrians as well as vehicles.

Besides these, the vegetable market at kilagal and Bhedasing, the blanket and cloth market at Indrachowk, the high commercial area of Makkhan invite the heavy flow of pedestrians as well as a tourist not only from the surrounding neighborhood but also from all parts of Kathmandu Valley.

The use of the ground floor as shops in all these streets along with street vendors running their business added more live activities and interesting to stroll in these places.

6.9. Problems and Issues

6.9.1. Narrow streets and no sidewalks

The streets in the urban core of Kathmandu were designed for the pedestrian in the past. So these streets are narrow without provisions for a sidewalk.

Traditionally they were brick-paved; however, owing to the modernization and change in lifestyle of people, these narrow pedestrians only. Today, along with the pedestrians, two-wheelers, private cars, public automobiles, and heavy trippers also run in these streets. During peak hours, large numbers of the pedestrian walk along with a high number of vehicles. The narrow streets without sidewalks for pedestrians are the main reasons for people being hit by vehicles in those streets.

6.9.2. Unmanaged Street Business and encroachment

The narrow streets in the urban core of Kathmandu meant for pedestrians are being increasingly encroached upon by street vendors and shopkeepers. The streets of Kilagal and Bhedasingh are one of the major vegetable markets after Ason. In the morning from 6-9 am and in the evening after 6 pm, hundreds of vendors occupy the street space for selling vegetables and a large number of people from the surrounding neighborhood come here to buy vegetables.

During the time, there is left very little space for pedestrians to walk. The 2 wheelers along with 4 wheelers and carts hinder pedestrian movement making the situation worse.

Though concerned officials are aware of the situation, they are not taking stringent actions to vacate the encroachers. Vendors even pay ransom to the authorities (ranging from Rs 10 to Rs 100 per day) to continue their business in these streets.

6.9.3. Heavy Flow of Vehicles

The streets of Phyphal, Kilagal, Bhedasingh, Indrachowk, and makkhan are always busy with high numbers of pedestrians and vehicles due to the busy vegetable market at Kilagal and Bhedasingh, It is one of the busiest streets in Kathmandu urban core due

to being close to the busiest market of Ason and also due to being the streets leading towards the Kathmandu Durbar Square.

In the early morning and afternoon hours, there is a flow of tripper and loader. At peak hours, there is always a flow of private cars, schools, minibuses, and a heavy flow of motorbikes.

The heavy flow of vehicles all day long with narrow streets further encroached upon by vendors pose lots of problems for pedestrians, There is always a fear of pedestrians being hit by vehicles and at peak hours, there is a heavy traffic jam of pedestrians and vehicles.

6.9.4. Noise pollution

There are a large number of people commuting through these streets at peak office hours. Pedestrians can't move freely due to the heavy flow of motorbikes and 4 wheelers. Moreover, the continuous honking by those vehicles causes extreme noise pollution making the pedestrian environment more pitiful.

6.9.5. Insufficient street lighting

One of the major problems in these streets is insufficient street lighting. The street lighting provided by the government bodies is not sufficient at night. The poor road condition, presence of potholes, broken stone pavements, and dangerous drain grates make walking more difficult in the absence of sufficient street lighting. Recently, the local club of the area is providing CFL lights at locations thereby fulfilling the lighting requirement to some extent. Insufficient street lighting has been the major cause of accidents and crimes such as theft and robbery in those streets.

6.9.6. Water logging problem

Due to the poor drainage system in the core area along with the lack of regular maintenance, the water logging problem has been one of the major problems in these streets. Being one of the major vegetable markets, a relatively large volume of solid waste is generated, Due to the problem in the timely collection of solid waste and plastic materials, the manholes are being frequently blocked causing overflow of water during rain. The pedestrian environment in the rainy season is due to a waterlogging problem.

6.9.7. Lack of safety and security provisions

According to Mr. Baburaja Maharjan; the president of the local star club, there was a provision of day guard and night guard to maintain the security of the area at the effort of the club, The club charges the shopkeeper and vendors for the security provided, But later, due to the dispute in the charging system, the shopkeeper did not agree to pay for it. So, at resent, there are no day and night guards. So, the security system is quite weak in this area, Theft and robbery are common and frequently occur.

6.9.8. Accidents

The streets of kilagl and Bhedasingh are paved with very slippery stone. When it rains, there are frequent bike slips with injuries to the bike riders. Pedestrians stuck over the potholes and broken stone pavements causing an accident. There are frequent cases of pedestrians being hit by motorbikes and 4 wheelers.

In Phyphal Street stretch, the street is blacktopped but the street condition is in poor condition. Due to the lack of maintenance and dif in the street for the water supply line, there is a lot of potholes. The poor condition of the drainage system has made both sides of the street muddy which is responsible for pedestrian slips and accidents.

At the Kilagal Street and Indrachowk, there is a lot of broken stone pavement. A frequent pedestrian accident occurs in these streets.

6.9.9. Weak traffic management system

In the narrow streets of the urban core, there is always a heavy flow of vehicles and people all day. Though there is a rule of one-way traffic management system in these streets, due to the poor implementation and lack of strict rules, vehicles enter from all directions. With the convergence of vehicles from all directions to the narrow streets, the traffic worsens and at peak hours, a traffic jam of more than half an hour can be seen. Pedestrians have to take the side of the street to wait for the vehicles to pass. Thus the weak implementation of the traffic management system has made the pedestrian environment more pitiful.

6.9.10. Unmanaged bike parking

Due to the lack of sufficient space for organized parking, people park their bikes along the side of the street, The small open space at Bhedsing Chowk and corner space at

phyphal is also being used for bike parking in the morning and evening. At Makkhan the space at the front of the commercial building Suraj arcade is being used for the bike parking. In the other case, the street side is being used for parking. The haphazard bike parking at the street side along with heavy encroachment by vendors and shopkeepers leaves very little space for pedestrians making the narrow street much narrower to walk.

6.9.11. Attractiveness

Despite lots of problems faced by pedestrians, there is still a heavy flow of people commuting these streets, the major attraction being the vegetable market of Kilagal and Bhedasing. People find them too lively, vibrant, and interesting because of the continuous flow of people and the incessant activities of the street vendors all day long. The feeling of enclosure in these streets, the dramatic change of surrounding at every node, and the fascinating streetscapes are the factors causing one to commute here.

7. CHAPTER VII: FINDINGS

7.1. Relationship of the built environment and walking behavior

Walking behavior depends upon overall walkability and walkability depends upon three major factors, viz. physical features of the pedestrian environment, urban qualities of the place, and individual reactions. The physical features include sidewalk, street width, traffic volume, tree canopy, surrounding building height, the flow of people, weather conditions, etc. Individual reactions mean the sense of safety, comfort, and level of interest. From my study, it is evident that walking behavior has a direct relation to the built environment.

The majority of the buildings in the urban core of Kathmandu are still 4-5 stories which is the human scale height. These buildings surround the narrow streets, thus giving a sense of enclosure. At the same time, the shadows they cast provide shade to the pedestrians from the sun while the temples and traditional rest houses provide shelter from the rain. The close association of the building and the continuous flow of people impart the feeling of safety and security to the pedestrians.

Kevin Lynch in his book “The image of the city” proposes that a city can be viewed by five elements i.e. paths, edges, districts, nodes, and landmarks. Our traditional urban core distinctly all these elements. The streets of the study area are paved with regular pattern stones. At each node is a remarkable element such as temples and open platforms; for example, Basanapur Durbar Square as landmark close to the large open space i.e. Tudikhel as an edge and the compact settlement as a district. These urban design qualities of the area knowingly or unknowingly attract a large number of pedestrians.

7.2. Relationship of pedestrian flow and land use

Pedestrian distribution differs as land use differs. In a mixed land use with diverse activities, pedestrian flow is higher than in purely residential, institutional, and other areas. In the mixed land-use area, pedestrian flow is almost constant with little variability during the day. But in other land uses, pedestrian volume is higher in certain hours and at other times, there are very few pedestrians.

In the case of streets in the urban core, the pedestrian distribution is high throughout the day. The volume increases in peak hours and reaches a maximum in the evening, due to the footpath business by street vendors. Daytime also witnesses a significant number of pedestrians due to the shops on the ground floors.

7.3. Relationship of pedestrian flow and footpath business

Street vending activities depend on pedestrian movement, proximity to the residence and wholesalers, and preference to certain locations.

Pedestrian flow and footpath business are directly proportional to each other. Street vendors are attracted to areas of high pedestrian flow. An increase in footpath business activities draws more pedestrians which then fetch more street vendors, thus contributing to a vicious cycle.

The streets of Kilagal and Bhedasing are the vegetable markets for the surrounding neighborhood. A large number of street vendors run their footpath business on either side of these streets. Indrachowk, being the traditional blanket and cloth market, and Makkhan, being a highly commercial area, street vending is the major character of the streets and has been the major attraction for a large number of pedestrians along these streets for shopping purposes.

Street vendors are attracted to these streets to run their business because large no. of people walks through these streets to get to the Durbar Square of Traditional market center Ason.

7.4. Overall pedestrian environment

The pedestrian environment of urban areas in Kathmandu is in a poor state. May it is the streets of historic core or highly commercial areas, pedestrian movement is not given much priority.

The streets in the historic core of Kathmandu are the places of social interaction with cultural meaning in the past and hence designed fully for pedestrians. The design of streets along with squares, dabalis, open spaces, temples, patis, etc. was guided by the culture and lifestyle of that time. The building height is maintained up to a maximum of 4 stories by the norms of a belief that residence height should not be higher than that

of temples. Due to the low building height, sufficient light can pass through the streets with sufficient ventilation making people with easy and comfortable movement.

But at present, along with modernization, the people's lifestyle has been drastically changed. Today, there is a high trend of using vehicles than walking and hence emphasizes area for vehicular movement than pedestrian and hence pedestrian need and comfort are not properly considered in any of the urban roads.

In the streets of the urban core, fewer storey residences turned into multistorey building up to 8 storeys. This along with narrow streets give the feeling of a tunnel. Pedestrian environment is further worsened by the poor pedestrian walkways, lack of urban design facilitates such as urban service center, public toilet, proper signage, street furniture, enough street lighting, proper pavement, heavy flow of vehicles, unmanaged parking, street encroachment by shopkeepers and vendors, untidy environment, noise pollution, proper drainage system, etc.

7.5. Institutional Framework

The institutional framework provided in the context at present is fragmented. The existing institutional arrangement available to educate and enforce vehicular traffic management is insufficient and the capacity of the institution must be reassessed. Under the provisions in the LSGA 199, KMC or municipalities are responsible for planning, designing, and managing the entire city, but due to lack of design guidelines the pedestrian space is in pathetic condition. So far KMC is ineffective to manage the street vendors and hawkers. The provisions of placing street furniture, dustbins, and green plants all fall on the responsibilities of the municipality. The out-of-order service lines like water supply pipes, exposed drainage cover, broken wires, snapped electric poles are the cases of responsibilities of different agencies but adding up the problems at the same pedestrian space. There must be a coordinating body to regulate all these.

The traffic management issue has also overlapping responsibility among Dept. of Transport management, Traffic police, Dept. of roads, and KMC. It is suffering from the usual tragedy of commons and each one pointing at others for owning the responsibility.

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Fragmented institutions having responsibilities of urban transport planning and management with least prioritized planning for pedestrians are as following:

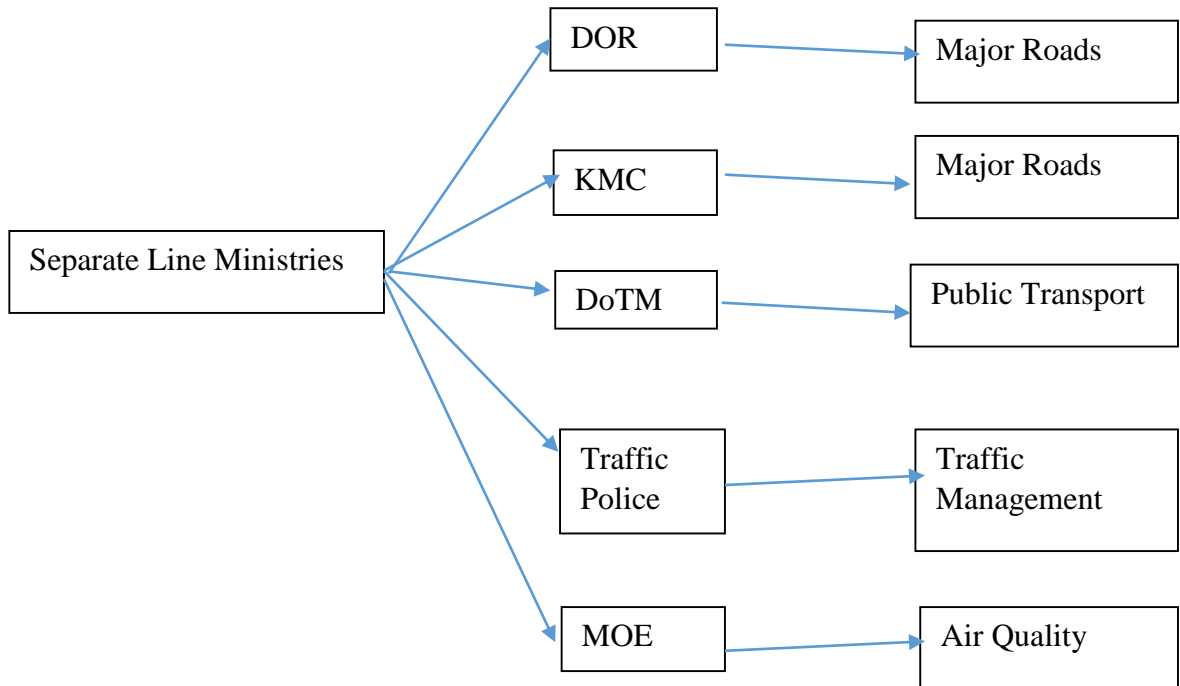


FIGURE 46: INSTITUTIONAL FRAMEWORK IN NEPAL

8. CHAPTER VIII: CONCLUSION

Urban areas are the center of attraction for people from all over the country in terms of better employment opportunities and other urban facilities. Thus urban areas are highly populated. In the context of Kathmandu, due to the centralization of infrastructure facilities, development, and many other administrative and security reasons, a high % of the population migrates and resides every year in the city. The high concentration of population has affected almost all sectors in an urban area. The increased population demands more infrastructure and facilities in terms of transportation, health, education, medical, and many others.

Transportation is one of the sectors, which has been greatly affected by the skyrocketing population in Kathmandu. The increased population every year demands more vehicles to run on the narrow streets which were designed many decades back for the limited number of vehicles. Due to the lack of provision of sufficient public vehicles and improper planning for pedestrians, there is a growing trend to use private vehicles even for shorter trips these days instead of walking in our urban areas.

Walking is the most fundamental form of mobility. It is expensive, emission-free, uses human power rather than fossil fuel, offers important health benefits, is equally accessible for all except those with substantially impaired mobility-regardless of income, and for many citizens is a source of great pleasure. Yet walking presents challenges to society's least robust individuals. The vitality of a city is closely linked to people being out and about on foot for many purposes. Walking is at the heart of urban life and contributes to liveable, attractive, prosperous, and sustainable cities.

Walking is, however, the neglected transport mode and despite being at the start and end of all trips, is rarely captured in government statistics on mobility and is often neglected in planning and policy development. Public institutions representing especially the interests of pedestrians- including the socially disadvantaged members of society who rely heavily on walking-are rare.

The pedestrian environments in the urban areas of Kathmandu are in worse condition in many cases. The roads even lack the minimum basic elements of pedestrian requirement such as minimum footpath width, sufficient street lighting, dustbin:

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signage boards, etc. The urban design facilities such as public toilets, street benches, drinking water, greeneries along the footpath, and facilities for proper parking are still far to incorporate in our urban roads. The urban roads in Kathmandu; are the narrow streets of Ason, movement of differently able people is not even thought of. Not only in the unplanned but also a planned settlement, has pedestrian environment even lacked minimum standard.

Even recent road expansion campaigns have discouraged pedestrian movement, degraded the streetscape, and replaced public spaces with traffic. The movement of differently-abled people is not even thought of in any of the road sections. Ramps are provided somewhere without having sufficient assessment and also do not match the standard to use by differently able people along with no provision of urban design facilities for pedestrians.

The major reason behind the poor pedestrian environment in our context is the lack of proper planning for the pedestrian in the urban areas, lack of norms, standards in our country regarding planning for pedestrians.

9. CHAPTER IX: RECOMMENDATIONS

9.1. Overview

Pedestrians are the lifeblood of urban areas and their role has significant contribution to maintain its character of the live and vibrant place. Besides, walking has uncounted benefits ranging from reduced air pollution, health benefits to people, reduction in the use of fossil fuel, etc. It is equally important to create a social environment with equity and justice. Hence, pedestrian facilities should be the prime concern at both local levels as well and national levels to encourage people for walking. Hence, while formulating the issues and problems, the recommendations are made accordingly from the general recommendations, site-specific recommendations, and general policies from the national level.

9.2. General problems and recommendations

9.2.1. Problem: poor pedestrian environment

The major problem pedestrians face while walking on the roads of urban areas in Kathmandu is the poor physical condition of walkways, narrow footpaths with minimum standard, lack of urban design amenities, i.e. Street furnishing, utilities, proper signage, lack of sufficient street lighting, proper greeneries, etc. From the streets of urban core areas to planned land use areas, pedestrian walkways are in worse condition along with lots of problems such as the presence of dangerous potholes, undulating surfaces, footpaths without pavements, water logging problems, etc. The narrow pedestrian footpaths further encroached by local shopkeepers and street vendors are also the major cause for disturbance in smooth pedestrian flow.

9.2.2. Recommendations

9.2.2.1. Improvement on the surface of the walkway

The surface of the footpath should be smooth and free from deviation. Pedestrians should be attracted to use the footpath by its texture and smoothness, at the same time it should be slip-resistant and stable. The land transport New Zealand (2007) suggests a maximum deviation of 5mm for the surface of the footpath. All surfaces on which pedestrians walk should be firm, stable, and slip-resistant even when wet.

The poor physical condition of the footpath in the context of our urban roads should be improved with regular inspection and timely maintenance if damaged. The surface of

the footpath should be evenly paved throughout and different functions along the footpath can be differentiated by different color pavements. The streets or footpaths paved with slippery stone pavement should be discouraged and removed.

9.2.2.2. Improved road section with the incorporation of street vendors

Street vendors are the essential character of urban areas which makes them live and vibrant all the time. So, street vending is not a problem but in our context, it seems so because of mismanagement and lack of appropriate vending space provided for them. So, street vending should be incorporated while designing the urban roads as a part of town-planning schemes.

Whereas the existing problem of pedestrian environment caused due to encroachment of street vendors can be reduced by providing specific street vending space to incorporate specific category of street vendors in certain sections with permitted schedule and regulatory measures (5-9 am and 5-9 pm) in one row on one side of the road and this not only facilitates for the need of pedestrian but also helps for pedestrian safety, commercial vitality and providing urban character.

In the wide footpaths, clear marking for the pedestrian way and street vending space may be done which limits street vendors to occupy only the provided space leaving the pedestrian walkway free for them.

9.2.2.3. Street Furnishings, Utilities, and Related Clearness

To improve the pedestrian environment in urban areas of Kathmandu, urban design elements and street furniture, such as benches, bus shelters, dust bins should be provided wherever possible. A pedestrian facility with these features creates an environment that encourages walking and social interactions. All obstructions such as street furniture, signposts, utility and signal poles, mailboxes, fire hydrants, and trees should be removed to make the footpaths free for pedestrians. These obstructions should be placed between the footpath and the roadway, to create a buffer for increased pedestrian ease. Clearance to vertical obstructions, such as signs and tree branches, must be at least 7 feet.

9.2.2.4. Pedestrian signage

Excessive commercialization of street signage has to be avoided. Specific pedestrian signage should be introduced with information of origin and destination places including the time distance for walking to reach the places. The haphazard use of signage and hoarding boards should be discouraged. The misinforming signage which distracts the pedestrians should not be allowed.

9.2.2.5. Establishing " zones of Footpath"

The pedestrian's space should be divided into distinct four zones as Edge, Furnishing, Throughway, and Frontage Zones wherever adequate space is available for pedestrians. These zones should be then properly designed with the necessary elements to facilitate efficient pedestrian movement.

9.2.2.6. Change in Behavioral Pattern

The current behavioral pattern of road users has to be changed for the efficiency and convenience of road users including pedestrians.

Driver's behavior

A driver should change their behavior of stopping at wrong places, honking unnecessarily, bike riders riding their bike through footpaths, neglecting pedestrians, speeding up dangerously which may cause risk to road users including pedestrians.

Pedestrian's behavior

Pedestrian should change their behavior of walking on roads rather than a footpath and not crossing the road through overhead bridges or zebra crossing.

Police behavior

Avoid overriding signals, practicing impunity in traffic regulations violators, giving priority to vehicles instead of pedestrians.

9.3. Recommendations in streets of the Urban core

9.3.1. Efficient traffic management system

The current pedestrian movement is difficult due to the heavy flow of vehicles in the narrow streets designed for a pedestrian in past. But since; restriction of vehicles entered in the streets of the urban core is unavoidable as they have been the part of life to the

urban city dwellers and the means to transport goods and services, the improvement of the pedestrian environment can be done through a proper and efficient traffic management system. Traffic management can be done in various ways as follows:-

9.3.1.1. One-way traffic system

The traffic system in the streets is much unmanaged. The entry and exit of vehicles from all the directions of streets is the major cause of traffic jams. The street is too narrow to accommodate two vehicles with a pedestrian at a time. So, a one-way traffic system could be one of the best solutions to improve pedestrian movement in the streets of the urban core.

9.3.1.2.. Entry of heavy vehicles at certain hours of the day

To facilitate pedestrian movement, the entry of heavy vehicles throughout the day should be restricted. Vehicles should be allowed only for certain hours of day viz. in the morning, 7 to 9 am or after 7 pm. This would help reduce traffic congestion and allow free pedestrian movement in peak hours and at other times.

9.4. General Policies

9.4.1. Management of footpath business

Footpath business is the essential character of our urban area making them live and vibrant all the time. Street vendors are the facilitator for the people to provide urban services at a cheap and affordable price with easy access. Besides this, in developing countries like Nepal, footpath business is the source of income for people with the low level of skill and differently able people, street vendor though is informal sector has a lot of contribution to the urban economy by catering to urban poor, reducing unemployment and poverty.

Accepting the fact they are part of our society and essential character of an urban area, they must be regularized in their street occupying activities. The probable vending pockets are to be incorporated in pedestrian space planning. However, both sides vending on a footpath must be discouraged, The space between the physically obstructing objects like tree guards, rest/sitting benches can be allowed for street vending, For the derivation of effective width of footpath in the transportation hub, the vendor factor must be included for design.

9.4.2. Building Controls

The pedestrian environment is largely affected by the surrounding buildings. Though the building bye-laws and regulations are quite adequate and the regulations are more detailed and specify parameters for the height, materials, and appearance of buildings but unfortunately, the regulations are enforced strictly. This has caused an un-uniformity of building heights making the urban streetscape visually disturbing. The unequal plinth height of buildings, private building's steps encroaching public footpath, house owners projecting cantilevers over the footpaths are few more examples causing pedestrian environment more problematic due to strict enforcement of bye-laws.

Thus, the concerned institution should be strengthened to implement the building bye-laws strictly to regulate the uniformity and footpath of the encroachment of the building by private buildings.

9.4.3. Institutional Proposal

Planning for pedestrians cannot be carried out in isolation. It should be integrated with the urban transport system. In the context of Nepal, we still lack the norms and standard road design incorporating proper planning for pedestrians. Our roads are designed only to address general issues of vehicular and pedestrian movement.

One single urban transport coordinating committee composed of representation from each of the following agencies to integrate the plans and programs. The committee will be responsible for the planning of vehicular as well as pedestrian planning of the city. The committee will follow the underpinning principle of integrating pedestrian planning into urban transportation systems to pave the way for sustainable urban transportation.

9.4.4. Appropriate Parking Policy

The parking policy essentially comprises of the following two categories which are prevalent in the streetscape of any urban road in Kathmandu.

9.4.4.1. On-street Parking Policy

As a general policy, on-street parking should be prohibited in all central area streets apart from designated areas. Charges should be levied in all these areas at an hourly

rate that gradually increases over time to reflect the cost of land and the privilege of parking on the road.

This policy implies that there is no free on-street parking within the area. In this way, the number of persons using personal vehicles can be controlled by the price of parking. As public transport becomes a more attractive alternative to personal transport the number of on-street parking spaces can be gradually reduced.

9.4.4.2. Off-Street Parking Policy

The off-street parking policy should be enhanced for better pedestrian facilities on the streetscape. Strict building regulations should be implemented to provide spaces for off-street vehicular parking. The off-street vehicular parking integrates pedestrians into the destination land use reducing less congestion on the street.

9.4.5. Revising the Road users hierarchy

To achieve an integrated approach, a different type of hierarchy called 'road user hierarchy' should be used, which suggests that pedestrians should always be kept at the top in road users hierarchy and their space should be market on the street, Most roads must accommodate a range of users. Their often conflicting requirements a balance to be struck in the level of service provided for each user group and the allocation of limited space to each.

Bibliography

- Anderson, W. P. (1996). Urban Form, Energy and the Environment: A review of Issues, Evidence and Policy. *Urban Studies*, 17-35.
- Angwenyi, O. P. (2016). Study on the adequacy of Street Infrastructure in the use of Urban Space in Kimathi Street, Nairobi Central Business District. Nairobi. *University of Nairobi*.
- Anne Vernez Moudon, C. L. (2006). Operational Definitions of Walkable Neighborhood: Theoretical and Empirical Insights. *Journal of Physical Activity and Health*.
- Bivina, G. R. (2019). Prioritizing pedestrian needs using a multi-criteria decision approach for a sustainable built environment in the Indian context. *Environment, Development and Sustainability*.
- Churchman, A. (1999). Disentangling the Concept of Density. *Journal of Planning Literature*, 389-411.
- Deore, P. &. (2008). *Contribution of Street Vendor in making Streets 'Public'*. CEPT University.
- Department for Transport, UK. (2002). *Inclusive Mobility*. Retrieved from <http://www.dft.gov.uk/transportforyou/access/peti/inclusivemobility>
- Department of the Environment Transport and the Regions (DETR). (2000). *Planning Policy Guidance Note3:housng*. London: DETR.
- Doiron, J. (2005). Economic Benefits of Pedestrianisation for Toronto. Toronto: *City of Toronto Council and Committees*.
- Frye, A. (2013). *Disabled and Older Persons and Sustainable Urban Mobility*. Nairobi. UN Habitat.
- Gakkai, K. K. (1995). Problems and Need of pedestrians. *International Association of Traffic and Safety Sciences.*, pp. 45-57.
- Giri, N. (2010). *Integration of Pedestrian Planning into Urban Transportation System*. Lalitpur, Nepal: Department of Architecture and Urban Planning.
- Grant, J. (2002). Mixed Use in Theory and Practice: Canadian experience with implementing a planning principle. *Journal of American Planning Association*, 71-84.
- Hass-Klau, C. (1993). *Impact of pedestrianization and traffic calming on retailing: A review of the evidence from Germany and the UK*. Brighton, UK: . Environmental and Transport Planning.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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- Healey, P. (1997). *Collaborative Planning: Shaping Places in Fragmented Societies*. Basingstoke: MacMillan Press Ltd.
- Hillier, B. a. (1984). *The Social Logic of Space*, Cambridge University Press. Cambridge: Cambridge University Press.
- Iranmanesh, N. (2008). Pedestrianisation a great necessity in urban designing to create a sustainable city in developing countries. *44th ISOCARP Congress*, 2.
- Jani, A. &. (2013). *Footpath Design: A guide to creating footpaths that are safe, comfortable and easy to use*.
- Kafle, S. (2017, Oct 22). Kathmandu's tourist hub Thamel becomes vehicle-free-zone. *Xinhuanet*.
- Kasula, N. (2016). *Pedestrianisation in Historic City Core, A Case Study of Bhaktapur*. Lalitpur: IOE, TU, Pulchowk Campus.
- Mackenzie, N. &. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research*, 1-11.
- MaYA (Manav-kendrit Yatayat Abhiyan). (2013). *Walkability in Kathmandu Valley*. Kathmandu: Clean Energy Nepal.
- Mitchell, C. (2005, June). *Get moving: Mobility in Europe and North America, Global Report on Ageing*. Retrieved from Global Report on Ageing: <http://www.aarpinter>
- Mofrad, S. S. (2013). *Pedestrianization: A Step toward urban sustainability*. Tehran, Iran: International Symposium on Advance in Science and Technology.
- Nettler, J. (2013, April 2). Street Vendors: Supporters or Spoilers of Public Space?
- NZ Transport Agency. (2009). *Pedestrian planning and design guide*. New Zealand: NZ Transport Agency.
- Pandit, S. S. (2016). *Integrating Riverside Development With Pedestrian Planning of Urban Roads: (A Case Study of Tripureswor - Thapathali Road Section)*. Lalitpur: Tribhuvan University.
- Pandit, S. S. (2016). *Integrating Riverside Development with Pedestrian Planning of Urban Roads: A case of Tripureshwor-Thapathali Road section*.
- Parveen, H. &. (2017). *Research ethics*. Retrieved from https://www.researchgate.net/profile/Nayeem_Showkat/publication/318912804_Research_Ethics/link
- Peterson, R. (2004). Land use planning and urban transport. Germany. *Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) GmbH*.

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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- Pham, L. (2018). *Qualitative Approach to Research A review of advantages and disadvantages of three paradigms: positivism, interpretivism and critical inquiry*. The University of Adelaide.
- pokherel. (n.d.). Green space suitability evaluation for urban. *Environmental Residential Community*.
- Pradhan, K. (2016). *Influencing Factors on Pedestrian Mode of Travel Choice: Lagankhel-Patan Durbar Square*. Lalitpur: IOE, TU, Pulchowk Campus.
- Rehan, R. M. (2012). Sustainable streetscape as an effective tool in sustainable urban design. *Housing and Building National Research Center Journal*, 173-186.
- Shrestha, B. k. (2011). Street typology in Kathmandu and street transformation. *ResearchGate*.
- Shrestha, S. (2015). *Pedestrianization of World Heritage Site*. Lalitpur, Nepal: Department of Architecture and Urban Planning.
- Söderholm, D. (2008). *THE COMMERCIAL STRUCTURE OF PEDESTRIAN STREETS AND SHOPPING DISTRICTS – THREE CASES FROM FINLAND*. Finland : UNIVERSITY OF HELSINKI.
- Southworth, A. F. (2008). Cities Afoot - Pedestrians, Walkability and Urban Design. *Journal of Urban Design*, 1-3.
- Talen, E. (2003). Neighbourhoods as Service Providers: a methodology for evaluating pedestrian access. *Environment and Planning*, 181-200.
- Trochim, W. (2006). *Research methods knowledge base (2nd ed.)*. Retrieved from <http://www.socialresearchmethods.net/kb/>.
- Williams, K. B. (2000). *Achieving Sustainable Urban Form*. London: E & FN Spon.

Annex

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Annex 1: Checklist for Street Observation

Surveyed By:

1. Name of the street:

2. Length of the street(m):

3. Width of the street(m):

4. Effective street width(m):

5. Road surface type:

a). Black topped b). Stone paved c). brick paved d).trail

6. Street Condition:

a). Well maintained b). Moderate c). Poor

7. Street Orientation:

a). North-South b).East-West

8. Side drain:

a). Yes b). No

9. Footpath Availability

a). Both sides b). One side c).None

10. Street Furniture/Resting Place/Amenities

a). Benches b). Pati c). Jahru d).Dustbin

11. Signage:

a).Properly positioned b).Improperly positioned c).No signage

12. Number of street connections:

13. Street environment:

a). Clean b). Moderate c).Dirty

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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14. Number of street lights:

15. Height of Street light(m):

16. Number of Street Vendors:

17. Street Parking:

a). Available b). Not available

c).Partially available

18. Obstacles:

a). Vehicles b). Pedestrian's crowd c). Narrow street/road

d).Dumping of waste materials e). Old houses/temples/monuments/Darbar

f).Street Vendors g).Illegal parking h).Others

19. Others characteristics:

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Annex 2: Questionnaire for Pedestrians

Interviewer:

1. Respondent's Name:

2. Gender:

a). Male b). Female

3. Age Group:

a). <15 years b). 15-25 years c). 26-35 years
d). 36-50 years e). 50-60 years f). >60 years

4. Address:

5. Occupation:

a). Service b).Business c). Student d).Agriculture e). Unemployed f).Others

6. Trip Origin: Where have you come from?

7. Trip Destination: Where are you going?

8. Trip Purpose: Why have you come here?

a). Residence b).Education c). Work d).Shopping e). Bus Station
f). Recreation g). Social Gathering h).Religious purpose i).Others

9. Travel Time: How much time does it take to walk from origin to destination

a). <5 minutes b). 5-10 minutes c). 10-15 minutes d).15-20 minutes
e). >20 minutes

10. Which route did you choose?

11. Why did you choose that route?

12. How many times do you use this street?

a). Everyday b). 2-3 times a week c). Once a week
d). Sometimes (less than once a week) e). Never

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

13. Vehicle Ownership: Do you own a vehicle?

- a). Yes b). No

14. Why do you choose pedestrian mode of transport?

- a). Short distance b). Low travel time c). Low travel cost d). Exercise
Potential for socializing e). Lively environment f). Shopping g).
Others

15. Why do you choose this particular path (this street) for your walking trips?

- a). Short distance b). Shopping options c). Visually attractive
d). Community attachment e). Tourist movement on the way
f). Convenient to walk g). Most familiar h). Less problem with traffic
i). Less population j). Security k). Others

16. Level of Congestion:

- a). Very congested b). Congested c). Neutral d). Free e). Very
free

17. Do you think the streets should be widen?

- a). Yes b). No

18. Level of comfort:

- a). Very uncomfortable b). Uncomfortable c). Neutral
d). Comfortable e). Very Comfortable

19. Level of Safety:

- a). Very Unsafe b). Unsafe c). Neutral d). Safe e). Very safe

20. Level of visual environment:

- a). Very bad view b). Bad view c). Neither bad nor good view d). Good
View e). Very good view

21. Level of street vitality:

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

- a). Very inactive b). Inactive c). Neither inactive nor active d). Active
e). Very active

22. Do you think the building facade affects your walking experience?

- a). Yes b). No

23. Do you think this street should be pedestrianised only?

- a). Yes b). No

24. Do you think public transport should be banned in these streets?

- a). Yes b). No

25. Which of these land use do you prefer in this street?

- a). Residential b). Commercial c). Mixed Use d). Public Building
e). Institutional f). Industrial g). Others

26. What problems do you face while walking?

- a). Crowdedness b). Safety concern due to motor vehicles c). No resting place
d). No sidewalk/not enough sidewalk e). Uneven Street/
Potholes/ Muddy street f). Dust/ Air pollution g). Long distance h). No signage
i). Not enough street lights j). Street encroachment by street vendors
k). Bad smell l). Security concerns(Pick Pockets)
m). No drinking water/public toilet n). Others

27. What are the main safety problems for pedestrians in this street?

- a). Lack of traffic lights and pedestrian crossings
b). Speeding and aggressive driving and drivers not following the traffic rules
c). Bad or missing sidewalks, sidewalks occupied by vehicles
d). Lack of street and area lighting or the fear of crimes
e). Lack of wheelchair and stroller accessibility f). Others

28. Do you think pedestrian traffic should be reduced?

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

- a). Strongly disagree b). Disagree c). Neither disagree nor agree d). Agree
e). Strongly Agree

29. Any route that you avoid?

30. Reason for avoiding route

- a). Insecurity b). Inconvenience (Narrow Street/Street Quality)
c). Road Safety d). Visually unpleasant e). Air Quality/Smell
f). Land use g). Others

31. Opinion on Street Vendors

- a). Facilitator b). Hindrance c). Indifferent

32. What strategy could make the street more pedestrian friendly?

- a). Pedestrian only (No motor vehicles) b). Part time pedestrian street
c). Shared Street d). Others

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Annex 3: Questionnaire for Residents

Interviewer:

1. Respondent's Name

2. Gender

a). Male b). Female

3. Age:

A0. <15 years b). 15-25 years c). 26-35 years d). 36-50 years e). 50-60 years f). >60 years

4. What is your place of origin?

a). Indigenous b). Migrated

5. Occupation:

a).Business b).Service c).Paralegal d).Housewife e). Driver f).
Student g). Singer h). Player i). Journalist j). Priest k).
Others

6. Ward No:

7. How many members in your family?

8. Vehicle Ownership: Do you own a vehicle?

a).Yes b). No

9. Where do you park your vehicle?

a). Own parking area b). Common parking area c). Side of the road/street
d). Outside of the house

10. Do you feel enjoyable while driving vehicle in these streets?

a). Yes b). No

11. Have you changed your building structure /typology use in recent 5 years?

a). Yes b). No

12. What are the different uses in your building?

a).Residential b). Commercial c). Institutional d).Others

13. Have you changed your building use recently?

a). Yes b). No

14. Do you prefer living here or would you like to shift in less pedestrian traffic area?

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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- a). Prefer living here b). Like to shift in less pedestrian traffic area
15. Have you changed your building façade to accommodate pedestrian needs?
- a). Yes b). No
16. Do you think this street should be pedestrianized?
- a). Yes b). No
17. Does the pedestrian traffic change the infrastructure of your town?
- a). Yes b).No
18. Opinion about Street Vendors:
- a). Facilitator b). Hindrance c). Indifferent
19. How do we make street more pedestrian friendly?
- a). Pedestrians only (No motor vehicles) b). Shared (For limited (morning and evening time) and emergency vehicles only c). Restriction for vehicles in day time d). No restriction of any vehicles e).Others

Annex 4 : Questionnaire for Shopkeeper

Interviewer:

1. Respondent's Name:

2. Gender:

- a). Male b). Female

3. Age

- A). <15 years b). 15-25 years c). 26-35 years d). 36-50 years e). 50-60 years f). >60 years

4. Type of Shop

- a). Clothing and accessories b). Grocery c). Jewelry d). Utensils e). Metal Crafts f). Others

5. Shop opening time:

6. Shop closing time

7. How do you transport goods for business?

- a). On foot b). On Bike/scooter c). On car/ van d). On truck

8. How often do you need transportation for goods?

- a). Everyday b). Once a week c). Once in 2 weeks d). Once a month
e). More than a month

9. At what time does this transportation take place?

10. How does transportation differ during Jatras and festivals (when road is unavailable)?

11. Which route is taken for vehicles during Jatras and festivals (when road is unavailable)?

12. How do customers come to your shop to buy goods?

- a). By walking b). By vehicle

13. When do more customers come to buy goods in your shop?

- a). Morning b). Day c). Evening

14. What is the peak business hour?

- a). 6am to 9am b). 9am to 12pm c). 12pm to 4pm d). 4pm to 7pm
e). After 7pm

15. Where do you park your vehicle?

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- a). Designated parking space b). Outside the shop c).Other
d). No vehicle

16. Opinion on Street Vendors:

- a). Facilitator b). Hindrance c). Indifferent

17. Opinion on Pedestrianization

- a). Fully pedestrianized b). Part time pedestrianization c). Pedestrian priority
d). Designate Footpath e). As it is f). Others

Annex 5 : Questionnaire for Vehicle Owner/Driver

Interviewer

1. Respondent's Name

2. Gender

- a). Male b). Female

3. Age:

- a). <15 years b). 15-25 years c). 26-35 years d). 36-50 years e). 50-60 years
f). >60 years

4. What is your place of origin?

- a). Indigenous b). Migrated

5. Where do you park your vehicle?

- a). Designated parking space b). Side of the road/street

6. How many customers do you transport by your vehicle in average a week?

- a). Less than 50 b). 50-100 c). 100-500 d). More than 500

7. How often do you use this street?

- a). Everyday b). Once a week c). Once in 2 weeks d). Once a month
d). More than a month

8. What is the peak busy hour of the street?

- a). 6am to 9am b). 9am to 12pm c). 12pm to 4pm d). 4pm to 7pm
e). After 7pm

9. Opinion about Street Vendors:

- a). Facilitator b). Hindrance c). Indifferent

10. How do we make street more pedestrian friendly?

- a). Pedestrians only (No motor vehicles) b). Shared (For limited (morning and evening time) and emergency vehicles only c). Restriction for vehicles in day time
d). No restriction of any vehicles e). Others

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Annex 6 : Pedestrian Survey Format

Street Name:

Date:

Enumerator's Name:

Pedestrian Count details at

Cross direction at

Direction:	From:	From:	Total	
Along footpath	To:	To:	Count	Hourly
Time Counted	No. of Pedestrian	No. of pedestrian		Count
8:00-8:15				
8:15-8:30				
8:30- 8:45				
8:45-9:00				
9:00-9:15				
9:15-9:30				
9:30-9:45				
9:45-10:00				
10:00-10:15				
10:15-10:30				
10:30-10:45				
10:45-11:00				
11:00-11:15				
11:15-11:30				
11:30-11:45				
11:45-12:00				
12:00-12:15				
12:15-12:30				
12:30-12:45				
12:45-1:00				
1:00-1:15				
1:15-1:30				
1:30-1:45				
1:45-2:00				
2:00-2:15				
2:15-2:30				

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2:30-2:45				
2:45-3:00				
3:00-3:15				
3:15-3:30				
3:30-3:45				
3:45-4:00				
4:00-4:15				
4:15-4:30				
4:30-4:45				
4:45-5:00				
5:00-5:15				
5:15-5:30				
5:30-5:45				
5:45-6:00				
6:00-6:15				
6:15-6:30				
6:30-6:45				
6:45- 7:00				
Total				

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Annex 7: Street Survey

Surveyed By:	Name of the street:	Length of the street(m):	Width of the street(m):	Effective street width(m):	Road surface type:	Street Condition:
Nilima	Makhan tole- indrachowk	300	2	5	Stone paved	Moderate
Prakash Rm	Pyaafal Road (Street 7)	380	4	5	Black topped	Moderate
Bipin Basnet	Bhedasingh	150	5	3.5	Stone paved	Poor
Dikshya Aakriti	Sukra Path	260	5	6	Black topped	Moderate
SUJAN BISHWAKARMA	STREET NO 3 INDRACHOWK TO ASAN	200	3.5	3	Stone paved	Moderate
Diwas baral	Street 1	600	5	5.5	Stone paved	Moderate
Sandesh Bhattarai	Ason- bangemuda	500	3.5	3	Black topped	Poor
Riwaz and prabin	Street 5		4	3	Stone paved	Moderate

Street Orientation:	Sid e dr ain :	Foot path Avail ability	Street Furniture /Resting Place/Amenites	Street Furniture/Resting Place/Amenites/Benches	Street Furniture/Resting Place/Amenites/Pati	Street Furniture/Resting Place/Amenites/Jahru	Street Furniture/Resting Place/Amenites/Dustbin
North - South	No	None	Benches	1	0	0	0
North - South	No	None	Benches Pati	1	1	0	0
East-West	No	None	Pati Benches	1	1	0	0
North - South	Yes	Both sides	Dustbin	0	0	0	1
East-West	No	None	Benches Dustbin	1	0	0	1
East-West	Yes	None	Benches Dustbin Pati	1	1	0	1
East-West	No	None	Benches Pati Jahru	1	1	1	0

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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North - South	Yes	None	Pati	0	1	0	0
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Signage:	Number of street connections:	Street environment:	Number of street lights:	Height of Street light(m):	Number of Street Vendors:
Properly positioned	4	Moderate	0	0	30
No signage	12	Moderate	35	6	24
No signage	2	Dirty	5	8	132
No signage	7	Moderate	16	7	12
No signage	9	Moderate	18	6.5	25
No signage	4	Moderate	15	7	10
No signage	4	Moderate	0	0	15
No signage	6	Moderate	4	6	64

Street Parking:	Obstacles:	Others characteristics:
Partially available	Narrow street/road	
Not available	Illegal parking	-Courtyard system on the left side of the street -Fusion of traditional & modern buildings -common parking system (Bahl)
Not available	Illegal parking	Tall building , narrow streets, dumps, street parking, no vendor shops, rapid movement of people.
Partially available	Pedestrian's crowd	Random parking
Partially available	Street Vendors	NARROW ROAD
Not available	Pedestrian's crowd	no
Not available	Narrow street/road	Crowdness,lack of parking access, foot path,street lighting
Not available	Vehicles	

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Street Parking:	Obstacles:	Others characteristics:
Partially available	Narrow street/road	
Not available	Illegal parking	-Courtyard system on the left side of the street -Fusion of traditional & modern buildings -common parking sytem (Bahl)
Not available	Illegal parking	Tall building , narrow streets, dumps, street parking, no vendor shops, rapid movement of people.
Partially available	Pedestrian's crowd	Random parking
Partially available	Street Vendors	NARROW ROAD
Not available	Pedestrian's crowd	no
Not available	Narrow street/road	Crowdness,lack of parking acess, foot path,street lighting
Not available	Vehicles	

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
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Annex 8 : Pedestrian Survey

Interviewer:	Respondent's Name:	Gender	Age Group:	Address	Occupation:	Trip Origin: Where have you come from?
Prakash Rm	Bikash Tamang	Male	15-25 years	Kritipur	Student	Kritipur
Prakash Rm	Komal Lal Shrestha	Male	>60 years	Pyaaafal	Unemployed	Pyaaafal
Prakash Rm	Ashish Shrestha	Male	36-50 years	Moru Baafal	Business	Moru Pyaaafal
Prakash Rm	Ashmita Thapa	Female	15-25 years	Nardevi	Student	Gangalal Hospital
Prakash Rm	Abinash Pujari	Male	<15 years	Dhalku	Student	Dhalku
Nilima	Puja	Female	15-25 years	Balaju	Student	Balaju
Nilima	Santosh	Male	15-25 years	Jadibutti	Student	Jadibutti
Nilima	Sanandan gupta	Male	36-50 years	Nawalparasi	Others	Bhagwanpau
Nilima	Sachita	Female	15-25 years	Patan	Unemployed	Patandhoka
Dikshya	Madhu shrestha	Female	26-35 years	Newroad	Business	Sindhuli
Dikshya	Anil rai	Male	36-50 years	Newroad	Business	Bangamoda
Dikshya kharel	Ishwor dahal	Male	15-25 years	Gathaghar bhaktapur	Business	Dolakha
Dikshya kharel	Lalit Agrawal	Male	36-50 years	Swastik chowk	Service	Swastik chowk
Dikshya kharel	Manish dhungana	Male	36-50 years	Pepsicola	Service	Pepsicola
Ritesh adhikari	Krishna Nepal	Male	15-25 years	Asan	Service	Asan
Ritesh Adhikari	Kabin tamang	Male	15-25 years	Asan	Others	Asan
Sujan bishwakarma	Nisha shrestha	Female	15-25 years	Patan	Student	Bagbajar
Sujan Bishwakarma	Ritika Sharma	Female	15-25 years	Naikap	Student	Newroad
Ritesh Adhikari	Prekshya Bhandari	Female	15-25 years	Kalimati	Student	Kalimati
Bipin Basnet	Bishnu Sadashankhar	Male	36-50 years	Chitwan	Unemployed	Chitwan
Bipin Basnet	Dipak magar	Male	15-25 years	Thankot	Business	Dhading

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Bipin Basnet	Lujulu maharjan	Female	26-35 years	Sano thimi	Unemployed	Sano Thimi
Bipin Basnet	Sumitra Chapagain	Female	36-50 years	Maruhiti	Others	Marutol
Bipin Basnet	Bipin Basnet	Male	15-25 years	Jhapa	Student	Jwagal
Aakriti	Krishna Dahal	Male	26-35 years	Old baneshwor	Business	Old baneshwor
Aakriti	Jyoti kc	Male	26-35 years	Kalanki	Business	Kalanki
Aakriti	Sunil Sharma	Male	15-25 years	Satdo bato	Student	Satdobato (home)
Aakriti	Ismita tamrakar	Female	15-25 years	Kupandole	Student	Sundhara
Aakriti	Sachin Shakya	Male	26-35 years	Koteswor	Unemployed	Koteswor
Suman Limbu	Susma Shrestha	Female	26-35 years	Gangabu	Business	Putali sadak
SUJAN BISHWAKARMA	TERESA RAI	Female	15-25 years	DHARAN	Student	SANEPa
RITESH ADHIKARI	NIRMALA SUNAR	Female	15-25 years	Baneshwar	Student	Baneswar
SUJAN BISHWAKARMA	SABINA MAHARJAN	Female	36-50 years	LAGANKHEL	Others	LAGNKHEL
SUJAN BISHWAKARMA	ANISHA RASAILY	Female	26-35 years	BALAJU	Others	KALIMATI
Diwas baral	Ankit subedi	Male	26-35 years	Basundhara	Student	Basundhara
Diwas baral	Epson chhetri	Male	15-25 years	Gagabu	Student	Gagabu
Hemanta limbu	Anish balami	Male	15-25 years	Basantapur	Student	Basantapur
Hemanta limbu	Supriya Dangol	Female	26-35 years	Bhaktapur	Service	Bhaktapur
diwas baral	Rojit tamang	Male	36-50 years	Jwagal	Business	Jwagal
Diwas baral	Hishila bajracharya	Female	15-25 years	Newroad	Student	New road
diwas baral	Aviyan panday	Male	15-25 years	Banasthali	Student	Banasthali
Alina	Anisha	Female	15-25 years	Balaju	Student	Balaju
Alina	Sita karki	Male	26-35 years	Tinkune	Business	Tinkune
Alina	Mohan Lal	Male	50-60 years	Chettrapati	Business	Assan

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Alina	Sapana	Female	15-25 years	Ekantakuana	Student	Pashupatinath
Alina	Teresa Rai	Female	15-25 years	Dharan	Student	Sanepa
Kiran Lama	Nirmala Shahi	Female	50-60 years	Teku	Business	Teku
Kiran lama	Suroj tamang	Male	15-25 years	Kirtipur	Student	Kirtipur
Kiran lama	Bishwo tamang	Male	15-25 years	Khanikhola	Unemployed	Dallu
Kiran lama	Bipina khadka	Female	15-25 years	Naradevi	Student	Hospital
Kiran lama	Sharbeswar neupane	Male	50-60 years	Bange mode	Business	Bange mode
Sandesh Bhattarai	Prem	Male	50-60 years	Ugratara mandir	Business	Local
Sandesh Bhattarai	Shakshyam sahi	Male	15-25 years	Tahacal	Student	Tachal
Sandesh Bhattarai	Subikshya limbu	Female	15-25 years	Tachikot	Student	Tachikot
Sandesh Bhattarai	Abhi rana magar	Male	<15 years	Ason	Student	Ason
Sandesh Bhattarai	Anushka bhagat	Female	15-25 years	Naradevi	Student	Jamal
Sandesh bhattarai	Anish bhagat	Male	26-35 years	Tachal	Business	Ason
Ujjwal dev	Sisir khadka	Male	<15 years	Ashan	Student	Jyatha
Ujjwal dev	Shyatam kumar	Male	15-25 years	Sundhara	Business	Sundhara
Ujjwal dev	Manish shakya	Male	15-25 years	Bhangemudha	Student	Auson-durbarhigh school
Ujjwal dev	Usha acharya	Female	26-35 years	Ason	Business	Ason
Dinesh thapa	Kishan silwal	Male	15-25 years	Thankot	Business	Nuwakot
Dinesh thapa	Adarsha pokhrel	Male	15-25 years	Manamaiju	Student	Manamaiju
Dinesh thapa	Suman saha	Male	15-25 years	Ganeshthan	Student	Ganeshthan
Dinesh thapa	Ismita manandhar	Female	15-25 years	Bhedasingh	Business	Bhedasingh
Dinesh thapa	Dinesh thapa	Male	15-25 years	Itahari	Student	Kopundol
Riwaz and prabin	Gopal baraili	Male	>60 years	Lolanheight	Business	Lolanheight

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Riwaz and prabin	Nima tamang	Female	15-25 years	Syambhu	Student	Syambhu
Riwaz and prabin	Kancha tamang	Male	15-25 years	Neukha	Others	Neukha
Riwaz and prabin	Ronak hada	Male	15-25 years	Thanhiti	Student	Thanhiti
Riwaz and prabin	Mira maharjan	Female	26-35 years	Thamel marga	Unemployed	Thamel marga
Riwaz and prabin	Jay Narayan dongol	Male	26-35 years	Jyatha marga	Agriculture	Maitripur
Riwaz and prabin	Surya adhikari	Male	26-35 years	Samakhusi	Agriculture	Samakhusi

Trip Destination: Where are you going?	Trip Purpose: Why have you come here?	Travel Time: How much time does it take to walk from origin to destination	Which route did you choose?	Why did you choose that route?
Hanuman Dhoka	Recreation	>20 minutes	Pyaaafal Road	Shopping Options
Shopping	Shopping	<5 minutes	Pyaaafal Road	Short Distance Most familiar Shopping Options
Shopping Groceries	Residence	<5 minutes	Dhaisa to Moru Baafal	Short Distance
Gangalal Hospital	Work	>20 minutes	Nardevi - Bansbari	Short Distance Most familiar
Basantapur	Recreation	15-20 minutes	Dhalku-Xettrapati - Basantapur	Short Distance Most familiar Visually attractive
Basantapur	Recreation	>20 minutes	Thamel	Most familiar
Durbar square	Social Gathering	>20 minutes	Koteshwor to ratnapark	Most familiar
Hanumandhoka	Religious purpose	>20 minutes	Bijeswori-dallu	Short Distance

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Hanuman dhoka	Social Gatherin g	15-20 minutes	Kupandol	Short Distance
Work here and go to home	Shopping	<5 minutes	Dallu nawardewi aspatal	Short Distance Less vehicular Traffic/ Road Safety
Bangewoda	Work	5-10 minutes	Sukrapath	Most familiar
Kathmandu area	Work	>20 minutes	Ratnapark	Most familiar Others (Mention)
Ratnapark	Recreati on	5-10 minutes	Swastik chowk route	Short Distance Shopping Options Religious Monuments on the way
Basantapur	Social Gatherin g	15-20 minutes	Ratnapark route	Most familiar Short Distance Others (Mention)
Bhimsenthan	Others	5-10 minutes	Asan indrachowk road 3	Short Distance
Kalimati	Work	10-15 minutes	Hanumandho ka-paropakarmar ga	Short Distance Security (Many people) Religious Monuments on the way
Rnac	Recreati on	>20 minutes	Basantpur ghumna	Religious Monuments on the way
Asan	Shopping	10-15 minutes	Newroad to asan	Shopping Options Security (Many people) Religious Monuments on the way
Asan	Shopping	>20 minutes	Newroad to asan	Short Distance Most familiar Shopping Options Security (Many people) Religious Monuments on the way
Kilagal	Social Gatherin g	>20 minutes	Kirtipur-kilagal	Most familiar
Kilagal	Recreati on	>20 minutes	Thankot-kalimati-kilagal	Short Distance
Indra Chowk	Social Gatherin g	>20 minutes	Sano thimi-Rnac-basantapur - Indra Chowk	Others (Mention)
Jamal	Shopping	15-20 minutes	Marutol-ganeshthan-Bhedasingh-Jamal	Most familiar Shopping Options Community Attachment Security (Many people)

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

			Jwagal- kupondol- newroad- Basantapur- Bhedasingh	Others (Mention)
Bheda singh	Work	>20 minutes		
New Road, (shop)	Work	15-20 minutes	Sundhara- Indrachowk	Most familiar
Shop at New road	Work	15-20 minutes	Rabi bhawan	Short Distance Visually attractive
Basantapur	Social Gatherin g	>20 minutes	Sundhara- basantapur	Most familiar
Shopping	Shopping	10-15 minutes	Sundhara- newroad	Most familiar Shopping Options
New road	Social Gatherin g	>20 minutes	Asan-sukra path	Comfort/ Wide Street comfortable to walk Visually attractive
Bishalbazar	Work	15-20 minutes	Ashan to bishalbazar	Short Distance Less Pollution Visually attractive
ASAN	Shopping	>20 minutes	NEW ROAD TO ASAN	Shopping Options
Asan	Shopping	15-20 minutes	NEWROAD TO ASAN	Shopping Options Security (Many people)
ASAN	Social Gatherin g	>20 minutes	KUPANDOLE	Most familiar Shopping Options
ASAN	Shopping	15-20 minutes	KALIMATI TO ASAN	Shopping Options Religious Monuments on the way
Kathmandu durbar square	Recreati on	>20 minutes	Ring road	Most familiar
Kathmandu durbar square	Religious purpose	>20 minutes	Ring road	Short Distance
Basantapur	Recreati on	5-10 minutes	Jhoccen	Short Distance
Kathmandu Durbar square	Recreati on	>20 minutes	RNAC ROUTE	Most familiar
Durbar square	Religious purpose	15-20 minutes	Pulchowk to ratnapark	Short Distance
Durbar square	Recreati on	<5 minutes	Maru street	Short Distance
Hanuman dhoka	Religious purpose	>20 minutes	Ring road	Short Distance
Basantapur	Recreati on	15-20 minutes	From thamel	Short Distance

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Durbar square	Religious purpose	>20 minutes	Hanuman dhoka	Visually attractive
Basantapur	Recreation	10-15 minutes	From indrachowk	Short Distance
Basantapur	Recreation	>20 minutes	Assan	Shopping Options Visually attractive
Asan	Shopping	>20 minutes	New road to Asan	Shopping Options
Moru Baafal	Work	10-15 minutes	Humat-Jaisideol-Chikywamol-Modu pyafal	Most familiar Short Distance
Basantapur	Recreation	>20 minutes	Kirtipur-balkhu-kalimati teku-sundhara basantapur	Short Distance Most familiar
Dallu	Recreation	10-15 minutes	Dallu to pyafal	Short Distance Most familiar
Basbari	Residence	<5 minutes	Santanswari mahadev	Short Distance Most familiar
Vulukha dewal	Social Gathering	5-10 minutes	Bange mode - tangle chowk -vulukha dewal	Short Distance Most familiar
Same place	Work	<5 minutes	Same road	Short Distance
Aashan	Others	15-20 minutes	Dallu	Less vehicular Traffic/ Road Safety
Aashan	Recreation	15-20 minutes	Tachikot	Short Distance
Basantapur	Recreation	>20 minutes	Shortest distance	Short Distance
Naradevi	Education	15-20 minutes	Ason - bangemuda	Short Distance
Tachal	Work	15-20 minutes	Shortest route	Short Distance
Bashantapur	Recreation	15-20 minutes	Bangemudha	Most familiar
Bangemudha	Work	5-10 minutes	Ashan - bandhemudha	Short Distance
Durbar high school	Education	10-15 minutes	Auson -durbar high school	Short Distance
Hanuman dhoka	Recreation	5-10 minutes	Ason - Hanuman dhoka	Short Distance

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Kilagal	Work	>20 minutes	Nagdhung to ratnapark	Most familiar
Nardevi	Recreation	>20 minutes	Manamaiju to ratnapark to nardevi	Most familiar
Gyatha	Shopping	15-20 minutes	Ganeshthan to bhedasingh to gyatha	Most familiar Short Distance
Bhedasingh	Work	<5 minutes	Street	Others (Mention)
Bhedasingh	Work	>20 minutes	Kopundol to Kathmandu durabr square to bhedasingh	Most familiar
Kheutol	Residence	>20 minutes	Lolanheight to jamal to bangemuda to kheutol	Short Distance
Basantapur	Residence	15-20 minutes	Kheutol	Short Distance
Indrachowk	Residence	<5 minutes	Kheutol	Short Distance
Hanuman dhoka	Residence	10-15 minutes	Kheutol	Short Distance
Basantapur	Residence	15-20 minutes	Kheutol	Short Distance
Basantapur	Residence	10-15 minutes	Maitripur to Kheutol to basantapur	Short Distance Shopping Options Most familiar Religious Monuments on the way
Indrachowk	Work	>20 minutes	Samakhusi to thamel marga to Kheutol to indrachowk	Short Distance Most familiar Religious Monuments on the way Security (Many people) Others (Mention)

How many times do you use this street?	Vehicle Ownership: Do you own a vehicle?	Why do you choose pedestrian mode of transport?	Why do you choose this particular path(this street) for your walking trips?
Sometimes (less than once a week)	No	Short distance Low travel time Shopping	Convenient to walk Most familiar Short dstance
Everyday	Yes	Short distance Low travel time Low travel cost	Short dstance Shopping options Most familiar

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Everyday	No	Short distance	Shopping options Most familiar Convenient to walk
Everyday	No	Short distance Low travel time Low travel cost	Short dstance Shopping options Most familiar Convenient to walk
Everyday	No	Short distance Low travel time Low travel cost	Short dstance Visually attractive Convenient to walk Most familiar
Sometimes (less than once a week)	No	Low travel time Low travel cost Potential for socializing	Visually attractive Convenient to walk Most familiar
Everyday	No	Lively environment	Shopping options Community attachment Most familiar
Sometimes (less than once a week)	No	Short distance	Short dstance Visually attractive
Once a week	Yes	Low travel time	Shopping options Visually attractive Community attachment
Everyday	Yes	Short distance	Short dstance
Everyday	No	Short distance	Short dstance
Everyday	No	Low travel cost	Others
Everyday	Yes	Short distance Shopping Others	Short dstance Visually attractive Convenient to walk
Everyday	Yes	Short distance	Short dstance Convenient to walk Others
Everyday	Yes	Short distance	Convenient to walk
Everyday	No	Short distance	Short dstance Convenient to walk
Sometimes (less than once a week)	No	Short distance	Short dstance
Once a week	No	Low travel cost Excercise Shopping	Shopping options Tourist movement on the way
Sometimes (less than once a week)	No	Short distance Shopping Excercise	Shopping options
Sometimes (less than once a week)	Yes	Others	Others Most familiar
Sometimes (less than once a week)	Yes	Others	Others
Sometimes (less than once a week)	No	Others	Convenient to walk Others

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

2-3 times a week	No	Shopping Low travel cost Lively environment	Most familiar Less problem with traffic Convenient to walk Shopping options
Never	No	Excercise Lively environment Shopping Others	Convenient to walk Shopping options Less problem with traffic Less population
Everyday	Yes	Low travel cost Low travel time	Convenient to walk
Everyday	Yes	Short distance	Short dstance Visually attractive
Sometimes (less than once a week)	No	Shopping Others	Shopping options Convenient to walk Most familiar
Once a week	No	Low travel cost Shopping Lively environment	Convenient to walk Shopping options Visually attractive
Sometimes (less than once a week)	No	Lively environment Low travel time	Visually attractive Most familiar Convenient to walk
Everyday	Yes	Short distance Excercise Lively environment	Short dstance Visually attractive
Sometimes (less than once a week)	No	Low travel cost	Shopping options
Once a week	No	Low travel cost	Shopping options
Once a week	No	Others Shopping	Shopping options Visually attractive Most familiar
Sometimes (less than once a week)	No	Short distance	Shopping options Short dstance
Everyday	Yes	Short distance	Short dstance
2-3 times a week	No	Short distance	Visually attractive
2-3 times a week	No	Short distance	Short dstance
Sometimes (less than once a week)	No	Lively environment	Visually attractive
Everyday	Yes	Lively environment	Tourist movement on the way Visually attractive
Everyday	No	Short distance	Short dstance
2-3 times a week	No	Short distance	Short dstance
Never	No	Low travel cost Low travel time Potential for socializing	Short dstance Less problem with traffic Convenient to walk
Once a week	No	Lively environment	Visually attractive
Everyday	No	Short distance Excercise	Short dstance Visually attractive

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Once a week	Yes	Short distance Excercise	Visually attractive Security
Once a week	No	Low travel cost	Shopping options
2-3 times a week	Yes	Short distance Low travel time	Most familiar Others
Sometimes (less than once a week)	No	Short distance Excercise	Short dstance Visually attractive Tourist movement on the way
Sometimes (less than once a week)	No	Short distance Low travel time Low travel cost	Short dstance Visually attractive Most familiar Shopping options
Everyday	No	Short distance Low travel time	Short dstance Visually attractive Community attachment
Everyday	No	Short distance Low travel time Excercise	Short dstance Most familiar
Everyday	Yes	Short distance	Short dstance
2-3 times a week	No	Short distance	Convenient to walk
Sometimes (less than once a week)	No	Short distance	Short dstance
2-3 times a week	No	Short distance	Short dstance
Sometimes (less than once a week)	No	Short distance	Short dstance
2-3 times a week	Yes	Short distance	Short dstance
Everyday	No	Short distance	Short dstance
Everyday	No	Short distance	Short dstance Shopping options
Everyday	No	Short distance	Short dstance
Everyday	No	Short distance	Short dstance
Sometimes (less than once a week)	Yes	Short distance	Most familiar
Sometimes (less than once a week)	No	Lively environment	Most familiar
2-3 times a week	No	Short distance Low travel time	Most familiar
Everyday	Yes	Others	Convenient to walk Most familiar Community attachment
Never	No	Others	Convenient to walk
Everyday	No	Short distance	Short dstance
Sometimes (less than once a week)	No	Short distance	Short dstance
Everyday	No	Short distance	Short dstance
Everyday	No	Short distance	Most familiar

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Everyday	No	Short distance	Most familiar
Everyday	No	Short distance Low travel cost Low travel time Excercise	Short dstance Shopping options Most familiar
Everyday	No	Short distance Low travel time Excercise Shopping Others	Short dstance Shopping options Most familiar Security Others

Level of Congestion	Do you think the streets should be widen?	Level of comfort:	Level of Safety:	Level of visual environment:	Level of street vitality:
Congested	Yes	Uncomfortable	Unsafe	Good View	Active
Congested	Yes	Neutral	Safe	Good View	Active
Neutral	No	Comfortable	Safe	Bad view	Active
Congested	No	Comfortable	Safe	Good View	Very active
Congested	Yes	Uncomfortable	Safe	Good View	Very active
Neutral	Yes	Comfortable	Safe	Good View	Very active
Very congested	Yes	Neutral	Safe	Very good view	Very active
Very congested	Yes	Comfortable	Safe	Very good view	Active
Congested	Yes	Neutral	Neutral	Good View	Very active
Very free	No	Comfortable	Neutral	Good View	Very active
Very congested	Yes	Uncomfortable	Neutral	Good View	Active
Neutral	Yes	Uncomfortable	Unsafe	Neither bad nor good view	Active
Congested	Yes	Neutral	Neutral	Neither bad nor good view	Active
Congested	Yes	Neutral	Neutral	Good View	Active
Very congested	Yes	Uncomfortable	Neutral	Good View	Very active
Very congested	Yes	Neutral	Safe	Bad view	Very active
Very congested	Yes	Uncomfortable	Neutral	Neither bad nor good view	Active
Very congested	Yes	Comfortable	Safe	Neither bad nor good view	Active
Congested	No	Neutral	Neutral	Good View	Active
Congested	Yes	Neutral	Neutral	Neither bad nor good view	Neither inactive nor active

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Neutral	No	Comfortable	Safe	Bad view	Neither inactive nor active
Free	No	Comfortable	Neutral	Bad view	Neither inactive nor active
Neutral	No	Comfortable	Very safe	Bad view	Active
Very congested	No	Uncomfortable	Safe	Very bad view	Very active
Neutral	No	Comfortable	Neutral	Good View	Very active
Congested	Yes	Neutral	Safe	Good View	Active
Neutral	Yes	Comfortable	Safe	Good View	Active
Neutral	Yes	Comfortable	Safe	Very good view	Active
Neutral	No	Comfortable	Safe	Neither bad nor good view	Active
Very congested	Yes	Neutral	Neutral	Good View	Active
Very congested	Yes	Neutral	Safe	Neither bad nor good view	Active
Congested	Yes	Comfortable	Neutral	Good View	Active
Very congested	Yes	Neutral	Safe	Very good view	Very active
Very congested	Yes	Very uncomfortable	Safe	Neither bad nor good view	Active
Neutral	No	Neutral	Neutral	Neither bad nor good view	Active
Neutral	No	Neutral	Neutral	Good View	Very active
Free	Yes	Neutral	Neutral	Good View	Active
Free	No	Neutral	Safe	Good View	Active
Congested	Yes	Neutral	Unsafe	Very good view	Active
Neutral	No	Very Comfortable	Very safe	Very good view	Active
Neutral	No	Comfortable	Unsafe	Neither bad nor good view	Active
Neutral	Yes	Comfortable	Safe	Good View	Very active
Very congested	Yes	Uncomfortable	Neutral	Very good view	Very active
Congested	No	Comfortable	Safe	Good View	Active
Neutral	No	Comfortable	Safe	Good View	Active
Very congested	Yes	Very uncomfortable	Unsafe	Very bad view	Active
Neutral	Yes	Comfortable	Safe	Good View	Neither inactive nor active
Free	Yes	Comfortable	Safe	Good View	Active

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Congested	Yes	Neutral	Unsafe	Good View	Active
Congested	Yes	Comfortable	Neutral	Good View	Very active
Congested	No	Comfortable	Safe	Good View	Very active
Very congested	Yes	Uncomfortable	Unsafe	Bad view	Very inactive
Congested	Yes	Uncomfortable	Safe	Bad view	Inactive
Congested	Yes	Comfortable	Unsafe	Bad view	Active
Congested	No	Uncomfortable	Unsafe	Bad view	Active
Congested	Yes	Neutral	Unsafe	Bad view	Very active
Congested	Yes	Uncomfortable	Unsafe	Bad view	Very active
Neutral	No	Very uncomfortable	Safe	Neither bad nor good view	Active
Congested	Yes	Uncomfortable	Unsafe	Neither bad nor good view	Active
Congested	Yes	Uncomfortable	Unsafe	Bad view	Very inactive
Neutral	Yes	Uncomfortable	Unsafe	Bad view	Active
Very congested	Yes	Uncomfortable	Neutral	Neither bad nor good view	Neither inactive nor active
Congested	Yes	Neutral	Neutral	Bad view	Active
Congested	Yes	Uncomfortable	Unsafe	Neither bad nor good view	Active
Congested	Yes	Very Comfortable	Safe	Neither bad nor good view	Active
Congested	No	Uncomfortable	Safe	Very bad view	Active
Very congested	Yes	Uncomfortable	Safe	Bad view	Very active
Congested	Yes	Neutral	Safe	Neither bad nor good view	Very active
Congested	Yes	Uncomfortable	Safe	Neither bad nor good view	Neither inactive nor active
Congested	Yes	Uncomfortable	Safe	Bad view	Active
Congested	Yes	Uncomfortable	Neutral	Bad view	Active
Congested	Yes	Uncomfortable	Neutral	Neither bad nor good view	Active
Congested	Yes	Neutral	Neutral	Bad view	Active

Do you think the building facade affects your walking experience?	Do you think this street should be pedestrianised only?	Do you think public transport should be banned in these streets?	Which of these landuse do you prefer in this street?	What problems do you face while walking ?
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**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

No	Yes	Yes	Commercial	Safety concern due to motor vehicles Crowdedness Bad smell
Yes	No	No	Mixed Use	No signage Safety concern due to motor vehicles
No	Yes	Yes	Mixed Use	Crowdedness
No	Yes	Yes	Mixed Use	No resting place Crowdedness Safety concern due to motor vehicles Street encroachment by street vendors
Yes	Yes	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles
Yes	Yes	Yes	Residential	Crowdedness Safety concern due to motor vehicles No sidewalk/not enough sidewalk Not enough street lights No drinking water/public toilet
Yes	No	Yes	Public Building	Crowdedness
Yes	Yes	Yes	Residential	Crowdedness Safety concern due to motor vehicles No sidewalk/not enough sidewalk No signage
No	Yes	Yes	Residential	Crowdedness No sidewalk/not enough sidewalk
No	No	No	Commercial	No drinking water/public toilet Not enough street lights Dust/ Air pollution Crowdedness
No	No	No	Commercial	No resting place Crowdedness Dust/ Air pollution Uneven Street/ Potholes/ Muddy street Others
No	No	No	Commercial	Crowdedness No resting place No drinking water/public toilet

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

No	Yes	Yes	Commercial	No drinking water/public toilet Crowdedness Others Bad smell
Yes	No	No	Mixed Use	Crowdedness No resting place Dust/ Air pollution Bad smell
No	Yes	Yes	Commercial	Crowdedness No resting place Security concerns(Pick Pockets) No drinking water/public toilet Street encroachment by street vendors
No	Yes	Yes	Mixed Use	Crowdedness No drinking water/public toilet Security concerns(Pick Pockets) Street encroachment by street vendors
No	Yes	Yes	Mixed Use	Crowdedness Security concerns(Pick Pockets) No drinking water/public toilet
No	Yes	Yes	Mixed Use	Crowdedness No drinking water/public toilet
No	No	Yes	Mixed Use	Crowdedness
Yes	Yes	No	Mixed Use	Crowdedness
No	Yes	Yes	Mixed Use	No resting place No sidewalk/not enough sidewalk
No	Yes	No	Residential	Crowdedness Safety concern due to motor vehicles No resting place No sidewalk/not enough sidewalk Dust/ Air pollution Bad smell
No	Yes	Yes	Commercial	Crowdedness Safety concern due to motor vehicles No resting place No sidewalk/not enough sidewalk Bad smell
Yes	Yes	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles No resting place No sidewalk/not enough

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

				sidewalk Uneven Street/ Potholes/ Muddy street Dust/ Air pollution No signage Not enough street lights Bad smell No drinking water/public toilet
No	No	No	Mixed Use	No drinking water/public toilet Safety concern due to motor vehicles No signage
No	No	No	Commercial	Crowdedness Safety concern due to motor vehicles No signage Not enough street lights
No	No	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles Bad smell No drinking water/public toilet
No	Yes	No	Commercial	Crowdedness No drinking water/public toilet
No	No	No	Mixed Use	Crowdedness Not enough street lights No signage Bad smell No drinking water/public toilet
Yes	Yes	Yes	Commercial	Safety concern due to motor vehicles
No	Yes	Yes	Mixed Use	Crowdedness
Yes	Yes	Yes	Mixed Use	Crowdedness
Yes	Yes	Yes	Residential	Crowdedness Safety concern due to motor vehicles Dust/ Air pollution No signage
No	Yes	Yes	Commercial	Crowdedness
No	Yes	Yes	Commercial	Crowdedness
Yes	No	Yes	Mixed Use	Crowdedness
Yes	No	No	Commercial	Crowdedness
No	Yes	Yes	Commercial	No drinking water/public toilet
Yes	Yes	Yes	Public Building	Crowdedness
Yes	Yes	Yes	Mixed Use	Bad smell
No	Yes	Yes	Mixed Use	Crowdedness

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

				Safety concern due to motor vehicles Crowdedness No signage
Yes	Yes	Yes	Mixed Use	
No	Yes	Yes	Others	Crowdedness
Yes	Yes	Yes	Mixed Use	No sidewalk/not enough sidewalk No signage
Yes	Yes	Yes	Commercial	Crowdedness Uneven Street/ Potholes/ Muddy street
No	Yes	Yes	Mixed Use	Crowdedness
Yes	Yes	Yes	Commercial	Safety concern due to motor vehicles Street encroachment by street vendors
Yes	Yes	Yes	Commercial	Crowdedness Safety concern due to motor vehicles
Yes	No	Yes	Residential	Safety concern due to motor vehicles Crowdedness Street encroachment by street vendors
Yes	Yes	Yes	Mixed Use	Crowdedness Street encroachment by street vendors
Yes	Yes	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles
Yes	No	No	Residential	Crowdedness
Yes	No	No	Residential	No sidewalk/not enough sidewalk
Yes	Yes	No	Residential	Crowdedness
Yes	No	No	Residential	Crowdedness
Yes	Yes	Yes	Residential	Safety concern due to motor vehicles Crowdedness
Yes	No	No	Residential	Crowdedness
Yes	No	No	Residential	Crowdedness
Yes	Yes	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles No resting place No signage
Yes	Yes	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles Not enough

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

				street lights Street encroachment by street vendors
Yes	No	No	Residential	Safety concern due to motor vehicles Crowdedness
No	Yes	Yes	Commercial	Crowdedness No resting place Dust/ Air pollution No sidewalk/not enough sidewalk
No	No	Yes	Mixed Use	No resting place Crowdedness No sidewalk/not enough sidewalk Bad smell
No	Yes	Yes	Mixed Use	Crowdedness No resting place No sidewalk/not enough sidewalk
No	Yes	Yes	Mixed Use	Crowdedness No sidewalk/not enough sidewalk
Yes	Yes	Yes	Mixed Use	Crowdedness Safety concern due to motor vehicles No resting place No sidewalk/not enough sidewalk Uneven Street/ Potholes/ Muddy street Dust/ Air pollution No signage Not enough street lights Bad smell
Yes	Yes	Yes	Mixed Use	Crowdedness
Yes	Yes	Yes	Mixed Use	No sidewalk/not enough sidewalk
Yes	No	No	Mixed Use	Crowdedness No sidewalk/not enough sidewalk
Yes	Yes	Yes	Commercial	No resting place
Yes	Yes	Yes	Mixed Use	Crowdedness No sidewalk/not enough sidewalk
Yes	No	No	Mixed Use	No sidewalk/not enough sidewalk Safety concern due to motor vehicles Crowdedness No resting place
Yes	No	No	Mixed Use	Crowdedness Safety concern due to motor vehicles No resting place

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

				No sidewalk/not enough sidewalk No signage Bad smell Street encroachment by street vendors No drinking water/public toilet
--	--	--	--	--

What are the main safety problems for pedestrians in this street?	Do you think pedestrian traffic should be reduced?	Any route that you avoid?
Bad or missing sidewalks, sidewalks occupied by vehicles Speeding and aggressive driving and drivers not following the traffic rules	Disagree	No any Road
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Neither disagree no agree	No any route
Lack of street and area lighting or the fear of crimes	Disagree	No any road
Speeding and aggressive driving and drivers not following the traffic rules Lack of traffic lights and pedestrian crossings	Agree	Killaghal
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Neither disagree no agree	Basantapur Road
Lack of traffic lights and pedestrian crossings Bad or missing sidewalks, sidewalks occupied by vehicles Lack of wheelchair and stroller accessibility	Neither disagree no agree	Don't know
Bad or missing sidewalks, sidewalks occupied by vehicles	Strongly Agree	No
Lack of traffic lights and pedestrian crossings Bad or missing sidewalks, sidewalks occupied by vehicles Others	Neither disagree no agree	Jholengepul-shobhqbhagwati
Lack of traffic lights and pedestrian crossings Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	No
Speeding and aggressive driving and drivers not following the traffic rules Lack of street and area lighting or the fear of crimes Others	Agree	Main entry area hospital side
Lack of traffic lights and pedestrian crossings Speeding and aggressive	Disagree	Banganeure

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

driving and drivers not following the traffic rules		
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles Lack of wheelchair and stroller accessibility	Neither disagree no agree	None
Lack of traffic lights and pedestrian crossings Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles Others	Neither disagree no agree	Not likely avoidable road all are same to come here
Lack of traffic lights and pedestrian crossings Speeding and aggressive driving and drivers not following the traffic rules Lack of street and area lighting or the fear of crimes	Neither disagree no agree	None
Speeding and aggressive driving and drivers not following the traffic rules	Strongly disagree	o2 road
Speeding and aggressive driving and drivers not following the traffic rules	Agree	Churagali
Speeding and aggressive driving and drivers not following the traffic rules	Agree	Churagali
Speeding and aggressive driving and drivers not following the traffic rules	Neither disagree no agree	Gali
Others	Neither disagree no agree	None
Bad or missing sidewalks, sidewalks occupied by vehicles	Neither disagree no agree	No
Bad or missing sidewalks, sidewalks occupied by vehicles Lack of street and area lighting or the fear of crimes	Agree	Not thought of
Bad or missing sidewalks, sidewalks occupied by vehicles Others	Strongly Agree	No
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Neither disagree no agree	No
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	No
Lack of traffic lights and pedestrian crossings	Agree	No
Lack of traffic lights and pedestrian crossings Lack of street and area lighting or the fear of crimes	Agree	Bhimsen than route

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Lack of traffic lights and pedestrian crossings	Neither disagree no agree	Not any
Lack of traffic lights and pedestrian crossings Lack of street and area lighting or the fear of crimes Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	No
Lack of traffic lights and pedestrian crossings	Neither disagree no agree	None
Speeding and aggressive driving and drivers not following the traffic rules	Neither disagree no agree	Gali
Others	Agree	NONE
Speeding and aggressive driving and drivers not following the traffic rules	Agree	Chura gali
Speeding and aggressive driving and drivers not following the traffic rules Others	Neither disagree no agree	O2 ROAD
Others	Agree	NONE
Speeding and aggressive driving and drivers not following the traffic rules	Agree	Yes
Others	Agree	Yes
Lack of street and area lighting or the fear of crimes	Neither disagree no agree	No
Lack of traffic lights and pedestrian crossings	Neither disagree no agree	No
Bad or missing sidewalks, sidewalks occupied by vehicles	Strongly Agree	No
Bad or missing sidewalks, sidewalks occupied by vehicles	Neither disagree no agree	No
Others	Neither disagree no agree	No
Lack of traffic lights and pedestrian crossings Bad or missing sidewalks, sidewalks occupied by vehicles Lack of wheelchair and stroller accessibility	Agree	No
Lack of street and area lighting or the fear of crimes	Agree	Don't know
Bad or missing sidewalks, sidewalks occupied by vehicles Others	Neither disagree no agree	Tangle
Lack of traffic lights and pedestrian crossings Lack of wheelchair and stroller accessibility	Agree	Doesn't know
Speeding and aggressive driving and drivers not following the traffic rules	Disagree	None
Speeding and aggressive driving and drivers not following the traffic rules	Disagree	Ason Road

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Disagree	No
Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	No any road
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	Kilaagar
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles	Disagree	No
Speeding and aggressive driving and drivers not following the traffic rules	Agree	Asan road
Speeding and aggressive driving and drivers not following the traffic rules	Disagree	No any route
Speeding and aggressive driving and drivers not following the traffic rules	Agree	Ashan
Speeding and aggressive driving and drivers not following the traffic rules	Strongly Agree	No any routes
Speeding and aggressive driving and drivers not following the traffic rules Lack of traffic lights and pedestrian crossings	Agree	Ason - makhan
Lack of traffic lights and pedestrian crossings	Agree	No any routes
Speeding and aggressive driving and drivers not following the traffic rules	Disagree	No any
Lack of traffic lights and pedestrian crossings Speeding and aggressive driving and drivers not following the traffic rules	Agree	No
Lack of traffic lights and pedestrian crossings Speeding and aggressive driving and drivers not following the traffic rules	Agree	No any
Speeding and aggressive driving and drivers not following the traffic rules Lack of traffic lights and pedestrian crossings	Agree	No routes
Lack of traffic lights and pedestrian crossings Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	No
Speeding and aggressive driving and drivers not following the traffic rules	Neither disagree no agree	No

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Bad or missing sidewalks, sidewalks occupied by vehicles		
Bad or missing sidewalks, sidewalks occupied by vehicles Lack of traffic lights and pedestrian crossings	Agree	No
Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	No
Bad or missing sidewalks, sidewalks occupied by vehicles Speeding and aggressive driving and drivers not following the traffic rules	Agree	No
Bad or missing sidewalks, sidewalks occupied by vehicles	Strongly disagree	Janawahal
Bad or missing sidewalks, sidewalks occupied by vehicles	Agree	Indrachowk to basantapur
Bad or missing sidewalks, sidewalks occupied by vehicles	Neither disagree no agree	Tangal to indrachowk
Bad or missing sidewalks, sidewalks occupied by vehicles Lack of wheelchair and stroller accessibility Lack of traffic lights and pedestrian crossings	Agree	Thanhiti to indrachowk to hanumandhoka
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles Lack of street and area lighting or the fear of crimes Lack of wheelchair and stroller accessibility	Strongly disagree	Thamel marga to asan to basantapur
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles Lack of wheelchair and stroller accessibility Others	Strongly disagree	Gagalal marga
Speeding and aggressive driving and drivers not following the traffic rules Bad or missing sidewalks, sidewalks occupied by vehicles Lack of wheelchair and stroller accessibility	Strongly disagree	Samakhusi to paknajolmarg to indrachowk

Reason for avoiding route	Opinion on Street Vendors	What strategy could make the street more pedestrian friendly?
Others	Facilitator	Pedestrian only (No motor vehicles)
Others	Indifferent	Shared Street
Others	Hindrance	Pedestrian only (No motor vehicles)

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Road Safety Inconvenience (Narrow Street/Street Quality)	Facilitator	Shared Street
Insecurity	Hindrance	Pedestrian only (No motor vehicles)
Others Landuse	Hindrance	Shared Street
Inconvenience (Narrow Street/Street Quality)	Hindrance	Pedestrian only (No motor vehicles)
Air Quality/Smell Visually unpleasant Insecurity	Hindrance	Pedestrian only (No motor vehicles)
Others	Hindrance	Pedestrian only (No motor vehicles)
Road Safety Others Inconvenience (Narrow Street/Street Quality)	Facilitator	Part time pedestrian street
Inconvenience (Narrow Street/Street Quality) Others	Facilitator	Shared Street
Others	Indifferent	Shared Street
Inconvenience (Narrow Street/Street Quality) Road Safety	Facilitator	Shared Street
Others	Indifferent	Shared Street
Inconvenience (Narrow Street/Street Quality)	Facilitator	Pedestrian only (No motor vehicles)
Inconvenience (Narrow Street/Street Quality)	Facilitator	Shared Street
Insecurity Inconvenience (Narrow Street/Street Quality)	Indifferent	Pedestrian only (No motor vehicles)
Insecurity Inconvenience (Narrow Street/Street Quality)	Facilitator	Pedestrian only (No motor vehicles)
Others	Facilitator	Part time pedestrian street
Others	Indifferent	Shared Street
Inconvenience (Narrow Street/Street Quality)	Indifferent	Shared Street
Others	Facilitator	Shared Street
Inconvenience (Narrow Street/Street Quality)	Facilitator	Shared Street
Others	Hindrance	Shared Street
Inconvenience (Narrow Street/Street Quality)	Hindrance	Pedestrian only (No motor vehicles)
Inconvenience (Narrow Street/Street Quality) Insecurity	Hindrance	Shared Street
Others	Facilitator	Shared Street
Inconvenience (Narrow Street/Street Quality)	Hindrance	Shared Street
Others	Hindrance	Shared Street
Insecurity	Facilitator	Pedestrian only (No motor vehicles)

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Others	Facilitator	Pedestrian only (No motor vehicles)
Road Safety Inconvenience (Narrow Street/Street Quality)	Facilitator	Part time pedestrian street
Insecurity Visually unpleasant	Hindrance	Pedestrian only (No motor vehicles)
Others	Facilitator	Pedestrian only (No motor vehicles)
Road Safety	Facilitator	Pedestrian only (No motor vehicles)
Others	Facilitator	Pedestrian only (No motor vehicles)
Visually unpleasant	Hindrance	Pedestrian only (No motor vehicles)
Others	Hindrance	Pedestrian only (No motor vehicles)
Inconvenience (Narrow Street/Street Quality)	Hindrance	Others
Others	Facilitator	Shared Street
Others	Hindrance	Pedestrian only (No motor vehicles)
Inconvenience (Narrow Street/Street Quality) Road Safety	Hindrance	Shared Street
Inconvenience (Narrow Street/Street Quality)	Hindrance	Shared Street
Inconvenience (Narrow Street/Street Quality)	Hindrance	Shared Street
Road Safety	Hindrance	Shared Street
Others	Indifferent	Part time pedestrian street
Road Safety Inconvenience (Narrow Street/Street Quality)	Hindrance	Pedestrian only (No motor vehicles)
Others	Facilitator	Pedestrian only (No motor vehicles)
Others	Facilitator	Shared Street
Inconvenience (Narrow Street/Street Quality) Insecurity Visually unpleasant	Facilitator	Pedestrian only (No motor vehicles)
Others	Hindrance	Pedestrian only (No motor vehicles)
Inconvenience (Narrow Street/Street Quality)	Hindrance	Shared Street
Others	Hindrance	Shared Street
Insecurity	Hindrance	Shared Street
Inconvenience (Narrow Street/Street Quality)	Hindrance	Shared Street
Inconvenience (Narrow Street/Street Quality) Road Safety	Indifferent	Shared Street
Others	Hindrance	Shared Street

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Others	Hindrance	Shared Street
Others	Hindrance	Pedestrian only (No motor vehicles)
Insecurity Visually unpleasant	Hindrance	Pedestrian only (No motor vehicles)
Others	Hindrance	Shared Street
Others	Indifferent	Pedestrian only (No motor vehicles)
Others	Indifferent	Shared Street
Others	Indifferent	Pedestrian only (No motor vehicles)
Others	Indifferent	Shared Street
Others	Hindrance	Shared Street
Others Inconvenience (Narrow Street/Street Quality)	Indifferent	Part time pedestrian street
Inconvenience (Narrow Street/Street Quality)	Indifferent	Shared Street
Inconvenience (Narrow Street/Street Quality)	Indifferent	Shared Street
Inconvenience (Narrow Street/Street Quality) Others	Indifferent	Part time pedestrian street
Inconvenience (Narrow Street/Street Quality)	Indifferent	Part time pedestrian street
Inconvenience (Narrow Street/Street Quality)	Indifferent	Part time pedestrian street
Inconvenience (Narrow Street/Street Quality) Air Quality/Smell	Indifferent	Part time pedestrian street

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Annex 9: Resident's Survey

Interviewer	Respondent's Name	Gender	Age:	What is your place of origin?	Occupation:
Prakash Rm	Mohini Tuladhar	Female	36-50 years	Indigenous	Business
Prakash Rm	Bishnu Lal Shrestha	Male	>60 years	Indigenous	Journalist
Nilima	Ramesh awal	Male	36-50 years	Indigenous	Business
Nilima	Indrajit dangol	Male	>60 years	Indigenous	Others
Dikshya kharel	Kiran rai	Female	36-50 years	Indigenous	Business
Dikshya kharel	Lokendra khadgi	Male	36-50 years	Migrated	Service
Ritesh Adhikari	Bal Krishna Prajapati	Male	>60 years	Indigenous	Others
Bipin Basnet	Sami sidhhiqi	Male	26-35 years	Migrated	Business
Bipin Basnet	Ruksan Darnal	Male	<15 years	Migrated	Business
Bipin Basnet	Mandip Rajbanshi	Male	15-25 years	Indigenous	Student
Bipin Basnet	Mina Manandhar	Female	>60 years	Indigenous	Housewife
Bipin Basnet	Dipesh ghatani	Male	26-35 years	Indigenous	Business
Aakriti	Gagan thapa	Male	36-50 years	Indigenous	Business
Aakriti	Kopila bista	Female	26-35 years	Migrated	Housewife
Aakriti	Kumar Rai	Male	50-60 years	Migrated	Business
SUJAN BISHWAKARMA	SUNIL MAHARJAN	Male	36-50 years	Indigenous	Service
RITESH ADHIKARI	Sunil Maskey	Male	36-50 years	Indigenous	Business
RKESH SHAH	RAKESH SHAH	Male	36-50 years	Indigenous	Business
RITESH ADHIKARI	SAMRAT MARJAN	Male	36-50 years	Indigenous	Service
Hemanta limbu	Nirmala Dangol	Female	36-50 years	Indigenous	Housewife
Diwas baral	Satya joshi	Male	36-50 years	Indigenous	Business
Diwas baral	sudarshan mahaju	Male	50-60 years	Indigenous	Business
Diwas baral	Rabin Shrestha	Male	15-25 years	Indigenous	Student
Hemanta limbu	Naren Koirala	Male	26-35 years	Migrated	Business
Diwas baral	Rajesh shrestha	Male	26-35 years	Indigenous	Service
Alina	Dil bahdur khadka	Male	50-60 years	Migrated	Service
Kiran lama	Ashok man bajracharya	Male	>60 years	Indigenous	Service
Kiran lama	Sunil shah	Male	26-35 years	Migrated	Business
Kiran lama	Binod Shrestha	Male	26-35 years	Indigenous	Service
Sandesh Bhattarai	Purnima karki	Female	26-35 years	Migrated	Business
Sandesh Bhattarai	Hareram shrestha	Male	50-60 years	Indigenous	Business

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Sandesh Bhattarai	Surya bahadur shrestha	Male	>60 years	Indigenious	Business
Ujjwal dev	Gautam maharjan	Male	50-60 years	Indigenious	Business
Ujjwal dev	Sushan shrestha	Male	36-50 years	Indigenious	Service
Riwaj and prabin	Prabhu sunuwar	Male	36-50 years	Migrated	Business
Riwaz and prabin	Ganga lal shakya	Male	36-50 years	Indigenious	Business

Ward No:	How many members in your family?	Vehicle Ownership: Do you own a vehicle?	Where do you park your vehicle?	Do you feel enjoyable while driving vehicle in these streets?	Have you changed your building structure /typology use in recent 5 years?
19	4	No	Common parking area	Yes	Yes
18	8	Yes	Common parking area	Yes	No
24	6	Yes	Outside of the house	No	No
19	8	No	Outside of the house	No	No
22	5	No	Own parking area	No	No
22	6	Yes	Own parking area	Yes	No
25	6	Yes	Own parking area	No	Yes
35	5	Yes	Side of the road/street	No	Yes
26	4	No	Outside of the house	No	Yes
18	5	No	Side of the road/street	No	No
24	2	No	Outside of the house	No	Yes
26	4	Yes	Common parking area	No	No
22	5	Yes	Common parking area	Yes	No
22	4	Yes	Side of the road/street	Yes	No

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

22	6	Yes	Own parking area	No	No
25	5	Yes	Own parking area	No	No
22	4	Yes	Own parking area	No	Yes
22	5	Yes	Own parking area	Yes	Yes
22	6	Yes	Own parking area	Yes	Yes
23	5	Yes	Own parking area	Yes	Yes
23	4	Yes	Own parking area	Yes	No
23	6	Yes	Own parking area	No	No
23	5	Yes	Own parking area	Yes	Yes
23	5	Yes	Own parking area	No	No
23	4	Yes	Own parking area	Yes	No
24	1	No	Common parking area	No	No
24	6	Yes	Common parking area	No	No
19	4	Yes	Common parking area	No	No
19	5	Yes	Own parking area	Yes	No
22	5	Yes	Own parking area	No	Yes
22	8	Yes	Common parking area	No	Yes
22	10	Yes	Own parking area	No	Yes
22	5	Yes	Own parking area	No	No
22	6	Yes	Own parking area	Yes	No
25	6	Yes	Common parking area	No	Yes
25	5	Yes	Own parking area	No	No

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

What are the different uses in your building?	Have you changed your building use recently?	Do you prefer living here or would you like to shift in less pedestrian traffic area?	Have you changed your building façade to accommodate pedestrian needs?	Do you think this street should be pedestrianized?	Does the pedestrian traffic change the infrastructure of your town?
Commercial Residential	Yes	Prefer living here	Yes	No	Yes
Residential	No	Like to shift in less pedestrian traffic area	No	No	Yes
Residential Commercial	No	Prefer living here	No	Yes	Yes
Residential	No	Like to shift in less pedestrian traffic area	No	Yes	Yes
Commercial	No	Prefer living here	No	No	Yes
Commercial Others Residential	Yes	Prefer living here	No	Yes	Yes
Commercial Residential	No	Prefer living here	No	Yes	No
Residential	Yes	Like to shift in less pedestrian traffic area	No	Yes	Yes
Commercial	Yes	Like to shift in less pedestrian traffic area	No	Yes	Yes
Commercial	No	Prefer living here	No	No	No
Residential	No	Prefer living here	No	No	No
Commercial	No	Like to shift in less pedestrian traffic area	No	Yes	Yes
Commercial	No	Prefer living here	No	Yes	Yes
Commercial	No	Prefer living here	No	No	Yes
Commercial	No	Prefer living here	No	No	Yes
Residential Commercial	No	Prefer living here	No	Yes	No
Commercial Residential	Yes	Prefer living here	No	Yes	Yes

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Residential Commercial	Yes	Prefer living here	Yes	Yes	No
Residential Commercial	Yes	Prefer living here	Yes	Yes	Yes
Residential Commercial	Yes	Prefer living here	Yes	Yes	Yes
Residential Commercial	No	Prefer living here	No	Yes	Yes
Residential Commercial	No	Like to shift in less pedestrian traffic area	No	Yes	Yes
Residential Commercial	Yes	Prefer living here	No	Yes	Yes
Residential Institutional	No	Prefer living here	No	Yes	Yes
Commercial Institutional	Yes	Prefer living here	Yes	Yes	Yes
Commercial	No	Like to shift in less pedestrian traffic area	No	Yes	Yes
Commercial Residential	No	Prefer living here	No	Yes	Yes
Residential Commercial	No	Prefer living here	No	Yes	Yes
Residential	No	Prefer living here	No	No	Yes
Residential Commercial	No	Prefer living here	No	No	No
Residential Commercial	Yes	Prefer living here	No	Yes	Yes
Commercial	Yes	Prefer living here	No	No	No
Residential Commercial	No	Prefer living here	No	Yes	Yes
Commercial	No	Prefer living here	No	Yes	No
Commercial	Yes	Like to shift in less pedestrian traffic area	Yes	Yes	Yes
Commercial	No	Prefer living here	No	No	Yes

Opinion about Street Vendors:	How do we make street more pedestrian friendly?
Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Hindrance	Pedestrians only (No motor vehicles)
Indifferent	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Pedestrians only (No motor vehicles)
Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)
Indifferent	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Restriction for vehicles in day time
Indifferent	Pedestrians only (No motor vehicles)
Indifferent	Pedestrians only (No motor vehicles)
Facilitator	No restriction of any vehicles
Hindrance	Others
Indifferent	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Facilitator	Others
Facilitator	Pedestrians only (No motor vehicles)
Facilitator	Pedestrians only (No motor vehicles)
Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)
Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)
Facilitator	Pedestrians only (No motor vehicles)
Hindrance	Restriction for vehicles in day time
Hindrance	Pedestrians only (No motor vehicles)
Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)
Facilitator	Pedestrians only (No motor vehicles)
Hindrance	Pedestrians only (No motor vehicles)
Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Restriction for vehicles in day time
Indifferent	Restriction for vehicles in day time
Indifferent	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Hindrance	Pedestrians only (No motor vehicles)

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Hindrance	Pedestrians only (No motor vehicles)
Indifferent	Restriction for vehicles in day time
Indifferent	Restriction for vehicles in day time

IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU

Annex 10 : Shopkeeper/Street Vendor Survey

Interviewer	Respondent's Name:	Gender:	Age	Type of Shop	Shop opening time:	Shop closing time
Prakash Rm	Parbati Archarya	Female	36-50 years	Grocery	10:00:00.000+05:45	18:20:00.000+05:45
Prakash Rm	Kamali Kulu	Female	36-50 years	Others	08:00:00.000+05:45	19:00:00.000+05:45
Prakash Rm	Sangam Shrestha	Female	15-25 years	Clothing and accessories	07:00:00.000+05:45	20:00:00.000+05:45
Nilima	Anjana lochan	Female	15-25 years	Clothing and accessories	10:52:00.000+05:45	11:00:00.000+05:45
Nilima	Parmila	Female	26-35 years	Others	17:00:00.000+05:45	18:00:00.000+05:45
Dikshya kharel	Ram shrestha	Male	26-35 years	Others	09:18:00.000+05:45	19:20:00.000+05:45
Bipin Basnet	Kiran Shakya	Male	36-50 years	Jewelry	11:00:00.000+05:45	18:00:00.000+05:45
Bipin Basnet	Sangita Gautam	Female	15-25 years	Grocery	07:00:00.000+05:45	20:00:00.000+05:45
Bipin Basnet	Nirendra Raj Bhandari	Male	50-60 years	Others	08:00:00.000+05:45	20:30:00.000+05:45
Bipin Basnet	Kritika Shakya	Female	15-25 years	Others	09:00:00.000+05:45	18:00:00.000+05:45
Bipin Basnet	Gyan Bahadur Thapa	Male	36-50 years	Metal Crafts	10:00:00.000+05:45	18:30:00.000+05:45

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Aakriti	Ishwor Dahal	Male	15-25 years	Clothing and accessories	10:00:00.000+05:45	19:00:00.000+05:45
Aakriti	Lalit agrawal	Male	36-50 years	Others	07:00:00.000+05:45	21:00:00.000+05:45
Aakriti	Shradha katuwal	Female	26-35 years	Clothing and accessories	10:00:00.000+05:45	20:00:00.000+05:45
Aakriti	Mohan kumar sapkota	Male	36-50 years	Jewelry	11:00:00.000+05:45	19:00:00.000+05:45
Sujan Bishwakarma	Rajaram karki	Male	36-50 years	Utensils	07:00:00.000+05:45	19:00:00.000+05:45
Sujan Bishwakarma	Kiran Basu	Male	26-35 years	Clothing and accessories	08:00:00.000+05:45	07:00:00.000+05:45
RITESH ADHIKARI	NARAYAN NEUPANE	Male	36-50 years	Clothing and accessories	08:00:00.000+05:45	07:00:00.000+05:45
RITESH Adhikari	PROJWAL Pradhan	Male	36-50 years	Metal Crafts	07:30:00.000+05:45	20:00:00.000+05:45
SUJAN BISHWAKARMA	SURESH SUNAR	Male	26-35 years	Utensils	07:00:00.000+05:45	19:00:00.000+05:45
Diwas baral	Angur baba subedi	Male	26-35 years	Clothing and accessories	07:00:00.000+05:45	20:00:00.000+05:45
Diwas Baral	Gopal Maharjan	Male	26-35 years	Metal Crafts	08:30:00.000+05:45	19:00:00.000+05:45
Diwas baral	Ramesh deupal	Male	36-50 years	Jewelry	08:00:00.000+05:45	19:30:00.000+05:45

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Hemanta limbu	Karan khadka	Male	26-35 years	Others	08:00:00.000+05:45	19:00:00.000+05:45
Hemanta limbu	Sabin shrestha	Male	26-35 years	Grocery	06:00:00.000+05:45	19:00:00.000+05:45
Alina	Usha	Female	36-50 years	Clothing and accessories	11:00:00.000+05:45	16:10:00.000+05:45
Alina	Aneel	Male	26-35 years	Grocery	06:00:00.000+05:45	19:00:00.000+05:45
Kiran lama	Yogendra sakya	Male	36-50 years	Others	09:00:00.000+05:45	07:00:00.000+05:45
Kiran lama	Susma rai	Female	26-35 years	Clothing and accessories	09:00:00.000+05:45	07:00:00.000+05:45
Sandesh bhattacharai	Suman sharma	Male	26-35 years	Clothing and accessories	10:04:00.000+05:45	19:04:00.000+05:45
Sandesh Bhattacharai	Saroj	Male	50-60 years	Grocery	10:01:00.000+05:45	18:00:00.000+05:45
Sandesh bhattacharai	Pradip shrestha	Male	26-35 years	Clothing and accessories	09:00:00.000+05:45	19:00:00.000+05:45
Ujjwal dev	Prashant kumar	Male	15-25 years	Metal Crafts	07:30:00.000+05:45	19:00:00.000+05:45
Ujjwal dev	Bikash shakya	Male	50-60 years	Grocery	07:00:00.000+05:45	20:30:00.000+05:45
Riwaz and prabin	Amala shrestha	Female	26-35 years	Others	08:00:00.000+05:45	18:00:00.000+05:45

**IMPACTS OF PEDESTRIAN TRAFFIC ON URBAN FORM:
A CASE OF HISTORIC CORE AREA OF KATHMANDU**

Riwaz and prabin	Diprenda agrawal	Male	26-35 years	Others	10:20:00.000+05:45	20:00:00.000+05:45
Riwaz and prabin	Mohan krishna shretha	Male	26-35 years	Clothing and accessories	09:45:00.000+05:45	07:00:00.000+05:45
Riwaz and prabin	Laxmi kumar maharjan	Male	36-50 years	Clothing and accessories	20:00:00.000+05:45	18:29:00.000+05:45

How do you transport goods for business?	How often do you need transportation for goods?	At what time does this transportation take place?	How does transportation differ during Jatras and festivals (when road is unavailable)?	Which route is taken for vehicles during Jatras and festivals (when road is unavailable)?
On foot	Everyday	09:00:00.000+05:45	No Transportation	No transportation
On car/ van	Once a month	06:00:00.000+05:45	No transportation During Festivals	Through Damai Tol Road
On Bike/scooter	Once a week	14:20:00.000+05:45	No transportation During Fests	Boudha - Ason - Nardevi
On car/ van	Once a week	17:53:00.000+05:45	It's difficult if jatras are for long time and sometimes shop are closed	Different route is taken(assana)
On foot	Everyday	10:00:00.000+05:45	Don't have problems	Makhan
On Bike/scooter	Once a week	13:30:00.000+05:45	Hard	Alternative route anyone..
On Bike/scooter	Once a week	09:00:00.000+05:45	No problem	None
On car/ van	Everyday	12:00:00.000+05:45	Slightly affects	S7
On Bike/scooter	Everyday	11:30:00.000+05:45	There is problem	S5
On foot	Everyday	09:00:00.000+05:45	Hotel business gets advantage.	Dont know
On Bike/scooter	Everyday	16:00:00.000+05:45	Problematic	S5 and s7
On foot	Once a week	18:30:00.000+05:45	Not faced any	By taking alternate route

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On Bike/scooter	Everyday	10:30:00.000+05:45	Yes, it affects customers	.
On Bike/scooter	Everyday	10:00:00.000+05:45	By walking	Taking alternate route
On Bike/scooter	Once a week	16:30:00.000+05:45	No transport service	Alternate
On car/ van	Once a month	19:00:00.000+05:45	Through person (bhariya)	asan to indrachwok road
On Bike/scooter	Once in 2 weeks	07:00:00.000+05:45	No transportation	We don't bring goods during jatras
On Bike/scooter	Once a week	07:00:00.000+05:45	GOOD IS BROUGHT THROUGH BHARIYAS	VEHICLES IS NOT USED
On Bike/scooter	Once a week	21:30:00.000+05:45	NO transportation IS USE FOR JATRA	NO alternative route
On car/ van	Once in 2 weeks	19:00:00.000+05:45	THROUGH BHARIYA	GOODS ARE TRANSPORTED IN THE EVENING
On Bike/scooter	Once a week	16:00:00.000+05:45	Walking \ foot	alternative
On foot	Once a month	06:30:00.000+05:45	No idea	alternative
On car/ van	Once a month	06:00:00.000+05:45	vehicles are restricted in that time so only walking is allowed	Makan galli
On Bike/scooter	Once a week	05:30:00.000+05:45	Vehicles are restricted so by Walking .	Makan galli
On Bike/scooter	Once a week	17:30:00.000+05:45	Vehicles are restricted so by walking	alternative
On Bike/scooter	Everyday	06:00:00.000+05:45	Shops are closed during khatra(street vendor)	No
On foot	Everyday	06:00:00.000+05:45	No business during jatras (fruit shop)	Shops are closed during jatras
On Bike/scooter	Once in 2 weeks	10:00:00.000+05:45	No	Uses same road
On Bike/scooter	Once a week	13:00:00.000+05:45	No transportation during festivals and jatras	No
On Bike/scooter	Everyday	18:05:00.000+05:45	Blockage during jatras and the shops remains closed	No transportation of vehicles
On Bike/scooter	Everyday	08:25:00.000+05:45	Road is blocked and shops remains closed	No transportation

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A CASE OF HISTORIC CORE AREA OF KATHMANDU**

On foot	Once a week	08:00:00.000+05:45	No transportation	No transportation due to blockage of road	
On Bike/scooter	Once a week	14:30:00.000+05:45	We dont bring goods	Alternative route . If emergency	
On foot	Once a week	13:30:00.000+05:45	No transportation due to blockage	No any option	
On foot	Once a month	06:00:00.000+05:45	Since jatras are not performed here so not effects here	Not jatras	
On car/ van	Once a week	12:00:00.000+05:45	No rathyatra but peoples crowded during jatras ,people movement is high	Bhangemoda to nardebi	
On foot	Once a month	14:15:00.000+05:45	Not rathyatra but peoples movemnt high during jatras	Bhangemoda to asan and bedhashing to nerdebi	
On foot	Once a week	12:52:00.000+05:45	No rath yatra but peoples crowded during jatras	Asan to nardebi	
How do customers come to your shop to buy goods?	When do more customers come to buy goods in your shop?	What is the peak business hour?	Where do you park your vehicle?	Opinion on Street Vendors:	Opinion on Pedestrianization
By walking	Morning	9am to 12pm	No vehicle	Facilitator	Part time pedestrianization
By walking	Evening	4pm to 7pm	Other	Indifferent	Designate Footpath
By vehicle	Evening	4pm to 7pm	Outside the shop	Hindrance	Designate Footpath
By vehicle	Evening	12pm to 4pm	Outside the shop	Hindrance	Designate Footpath
By walking	Day	12pm to 4pm	No vehicle	Hindrance	Fully pedestrianized
By vehicle	Day	12pm to 4pm	Designated parking space	Facilitator	As it is
By walking	Evening	4pm to 7pm	Other	Hindrance	Fully pedestrianized
By walking	Morning	9am to 12pm	Outside the shop	Facilitator	Designate Footpath

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By walking	Day	12pm to 4pm	Outside the shop	Indifferent	As it is
By walking	Day	12pm to 4pm	No vehicle	Indifferent	Designate Footpath
By walking	Day	12pm to 4pm	Outside the shop	Indifferent	Designate Footpath
By vehicle	Day	12pm to 4pm	No vehicle	Facilitator	Designate Footpath
By vehicle	Day	12pm to 4pm	Outside the shop	Facilitator	As it is
By walking	Day	12pm to 4pm	Outside the shop	Facilitator	Designate Footpath
By vehicle	Day	4pm to 7pm	Outside the shop	Hindrance	As it is
By walking	Day	12pm to 4pm	No vehicle	Facilitator	Fully pedestrianized
By walking	Day	12pm to 4pm	Outside the shop	Facilitator	Pedestrian priority
By walking	Day	12pm to 4pm	Outside the shop	Hindrance	Pedestrian priority
By walking	Day	12pm to 4pm	Designated parking space	Facilitator	Fully pedestrianized
By walking	Day	12pm to 4pm	Other	Hindrance	Pedestrian priority
By walking	Day	12pm to 4pm	Designated parking space	Hindrance	Fully pedestrianized
By walking	Day	12pm to 4pm	No vehicle	Facilitator	Pedestrian priority
By walking	Day	12pm to 4pm	Designated parking space	Hindrance	Fully pedestrianized
By walking	Day	12pm to 4pm	No vehicle	Hindrance	Fully pedestrianized
By walking	Day	12pm to 4pm	No vehicle	Hindrance	Fully pedestrianized
By walking	Morning	6am to 9am	Outside the shop	Facilitator	Pedestrian priority
By walking	Morning	4pm to 7pm	No vehicle	Hindrance	Designate Footpath
By walking	Day	12pm to 4pm	Designated parking space	Facilitator	As it is
By vehicle	Evening	4pm to 7pm	Outside the shop	Indifferent	Fully pedestrianized
By vehicle	Morning	9am to 12pm	Outside the shop	Indifferent	Fully pedestrianized
By walking	Morning	9am to 12pm	No vehicle	Hindrance	Fully pedestrianized

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By vehicle	Day	9am to 12pm	Outside the shop	Hindrance	Fully pedestrianized
By vehicle	Day	12pm to 4pm	No vehicle	Facilitator	Part time pedestrianization
By walking	Evening	4pm to 7pm	No vehicle	Indifferent	Pedestrian priority
By walking	Day	12pm to 4pm	No vehicle	Indifferent	Pedestrian priority
By vehicle	Day	12pm to 4pm	No vehicle	Indifferent	Pedestrian priority
By walking	Day	12pm to 4pm	Other	Indifferent	Part time pedestrianization
By walking	Day	12pm to 4pm	No vehicle	Indifferent	Pedestrian priority

Annex 11 : Vehicle Owner Survey

Interviwer	Respondent's Name	Gender	Age:	What is your place of origin?	Where do you park your vehicle?
Prakash Rm	Om Prakash Nepali	Male	26-35 years	Migrated	Side of the road/street
Prakash Rm	Mohan Shrestha	Male	36-50 years	Indigenous	Side of the road/street
Nilima	Vijay jain	Male	26-35 years	Migrated	Side of the road/street
Dikshya	Sirish majhi	Male	36-50 years	Indigenous	Designated parking space
Dikshya kharel	Rishi sakya	Male	26-35 years	Migrated	Designated parking space
Dikshya kharel	Sankhar tamang	Male	36-50 years	Migrated	Side of the road/street
Dikshya kharel	Abinash chand	Male	26-35 years	Migrated	Side of the road/street
sujan bk	Narayan nupane	Male	50-60 years	Indigenous	Designated parking space
Bipin Basnet	Raju Bhattarai	Male	26-35 years	Migrated	Side of the road/street
BIPIN Basnet	Suresh Tamang	Male	36-50 years	Migrated	Designated parking space
Aakriti	Krishna katel	Male	36-50 years	Migrated	Designated parking space
Alina	Prem bk	Male	50-60 years	Migrated	Side of the road/street
Alina	Abinash karki	Male	26-35 years	Indigenous	Designated parking space

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Kiran lama	Prakash shrestha	Male	36-50 years	Migrated	Side of the road/street
Sandesh bhattarai	Raj sunuwar	Male	26-35 years	Migrated	Side of the road/street
Sandesh bhattarai	Dinesh Kumar rai	Male	36-50 years	Migrated	Side of the road/street
Ujjwal dev	Anisha chackradhar	Female	26-35 years	Indigenous	Designated parking space
Ujjwal dev	Amrit sunuwar	Male	26-35 years	Migrated	Designated parking space
Riwaz and prabin	Diraj shakya	Male	26-35 years	Migrated	Side of the road/street
Riwaz and prabin	Sanjeev yadab	Male	26-35 years	Migrated	Side of the road/street
Riwaz and prabin	Ayub kafle	Male	26-35 years	Migrated	Side of the road/street
Riwaz and prabin	Amar limbu	Male	26-35 years	Migrated	Side of the road/street

How many customers do you transport by your vehicle in average a week?	How often do you use this street?	What is the peak busy hour of the street?	Opinion about Street Vendors:	How do we make street more pedestrian friendly?
50-100	Everyday	4pm to 7pm	Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Less than 50	Everyday	9am to 12pm	Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Less than 50	Everyday	12pm to 4pm	Hindrance	No restriction of any vehicles
50-100	Everyday	12pm to 4pm	Facilitator	No restriction of any vehicles
50-100	Once a week	12pm to 4pm	Hindrance	No restriction of any vehicles
100-500	Everyday	9am to 12pm	Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)

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50-100	Once a week	4pm to 7pm	Facilitator	No restriction of any vehicles
Less than 50	Everyday	12pm to 4pm	Facilitator	Shared (For limited (morning and evening time) and emergency vehicles only)
Less than 50	Everyday	9am to 12pm	Hindrance	No restriction of any vehicles
100-500	Once a week	9am to 12pm	Hindrance	No restriction of any vehicles
50-100	Everyday	12pm to 4pm	Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Less than 50	Once a week	6am to 9am	Hindrance	Shared (For limited (morning and evening time) and emergency vehicles only)
Less than 50	Once a month	4pm to 7pm	Hindrance	Pedestrians only (No motor vehicles)
Less than 50	Everyday	12pm to 4pm	Hindrance	No restriction of any vehicles
50-100	Once a week	9am to 12pm	Hindrance	No restriction of any vehicles
50-100	Once a week	9am to 12pm	Hindrance	No restriction of any vehicles
Less than 50	Once a week	9am to 12pm	Hindrance	No restriction of any vehicles
Less than 50	Everyday	9am to 12pm	Hindrance	No restriction of any vehicles
Less than 50	Everyday	9am to 12pm	Indifferent	Restriction for vehicles in day time
Less than 50	Everyday	9am to 12pm	Indifferent	Shared (For limited (morning and evening time) and emergency vehicles only)
Less than 50	Everyday	9am to 12pm	Indifferent	Restriction for vehicles in day time
Less than 50	Everyday	9am to 12pm	Indifferent	Restriction for vehicles in day time

Annex 12 : Key Informants Interview

Respondent Name : Mr. Gaurav Shrestha,

Position : Architect and Urban Planner

Institution : Kathmandu Metropolitan City

According to Mr. Gaurav Shrestha, Architect and Urban Planner of Kathmandu Metropolitan City, the pedestrian environment is unlikely in the historic city. According to him, historic roads, since the settlement established the road network used to cater those population density but nowadays due to increase in population density and pedestrian traffic, the street cannot cater those pedestrians. In past, all built buildings were all used for residential purposes only but nowadays, residential buildings change to commercial purposes. Settlement pattern changes can be observed. Most of the house owners of this area give the house in rent and choose to live in outskirts which results in the street dead after 8 PM.

The building footprint is high in this area as many daily wage workers, informal workers, immigrant laborers reside in the historic core are due to low rent value. The urban form is changed at present than past as the tenants are dominant in this area. The manpower needed for Kathmandu is residing in this area as informal workers reside here. If a natural disaster occurs then it affects the whole people residing here. Due to lockdown, many people living in this area migrate to their villages.

There is a direct relationship between pedestrian traffic and urban form. When the daily activities are observed from morning to evening then we see from 5 AM-8 AM, the street vendors occupy the footpath of the streets, during 8 AM-8 PM, the shopkeepers encroach the street and after 8 PM-5 AM the streets are dead.

The positive impacts of pedestrian traffic are that economic activities occur in all these streets of the historic core area due to pedestrian movement. There is a negative impact on social activities as social activities in the historic area are happening very few in the present context. There is less participation of residents in social activities. There is a direct negative impact on the tangible and intangible heritage of historic cities as there is a missing of transferring generation rituals. During chariot pulling, maximum immigrant people participate in these jatras and parbas rather than the residents. The

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road of the historic core area was build for the pedestrian purpose only nowadays the streets are used by the pedestrian and vehicular movement. Due to high pedestrian volume, there is a deficit in urban infrastructure as well as there are solid waste problems. Mostly the road in the historic area is stone-paved which is generally 3” thick but due to vehicular movement and pedestrian traffic, the stone-paved road is frequently degraded.

He recommends that the vehicle movement should be regulated, shop owner loading and unloading time should be regularized and street vendors should be timely regularized.

Respondent Name : Mr. Saroj Basnet

Position : Vice-chairman

Institution : City Planning Commission, KMC

The pedestrian environment is different in various streets of this area. Ason has different where two types of pedestrian movement can be observed. One is people come to Ason for shopping purposes and the other is people use Ason as a transit route and goes to their destination. For bazaar, people come less in number. During the office time, Ason-Indrachoek-Makhan route there is highly pedestrian movement. People prefer more this diagonal route for short distances.

According to him, the load-carrying capacity cannot cater to more people which results in traffic. Street vendors in the streets cause congestion, shopkeeper keeps their goods on the street side, porter, rickshaws, motorized vehicles causes traffic which creates problems for pedestrian movement. Markets and shopping centers are the main reason behind the pedestrian traffic.

In his words, the current situation of urban form in the historic city of Kathmandu is old buildings are demolished and new buildings are constructed. Open spaces, chowks, and courtyards are seen retained. The building use has been changed in present compared to past. Purely commercial activities are seen in the most street. Few people only can be seen in the shows. Historical buildings are mostly commercialized and the height of private buildings is increased nowadays.

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There is more relationship between urban form and pedestrian traffic. Urban form attracts more pedestrians. Now the new relationship is defined by the markets rather than the urban form. Historically Ason is a bazaar where any goods needed from birth to death and from salt to gold can be found so that more pedestrian movement can be seen in this street. Historically Ason can be observed as commercial activities.

Urban form especially the courtyard which was built for a specific purpose is nowadays, is changed into a warehouse, storeroom for storing goods by the shopkeepers. Commercial activities are seen as dominant. This entire area has become overly commercialized rather than developing arts and crafts, tourism aspects which result incompatible between pedestrian and urban forms. Nowadays Chinese market, Hongkong markets, and other markets selling domestic goods are only dominant which destroys the existing urban form of this area.

He recommends that the government should support while constructing group housing or new buildings so that the tourism-related urban form can remain intact. The policy should be made such that the tourism, cultural heritage and arts-related business can be promoted which can keep intact the urban form of this area. For example, in the case of neighborhood development, local businesses like local teashop, local cuisine, local café, etc. can keep intact the urban form. In case of pedestrian traffic in most streets, alternative routes should be created with proper signage, the street vendor should be managed, motorized vehicles should be regularized with certain routes and certain timing as well as the transportation of goods by the shopkeeper should be regularized with a certain time.

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Respondent Name : Mrs. Alina Kumari Tamrakar

Position : Consultant Architect

Institution : UNESCO Kathmandu

Most of the streets are narrow in this area. The pedestrian environment is variant nature in a different street. The vehicular movement is restricted during the daytime near Kathmandu Durbar Square. The street along the Indrachowk-Ason route is almost commercial. During morning time there is more crowd along Bangemuda-Bhedasingh street. There is a big open space in Itumbahal where people used to spend their leisure time but it turns out to be a parking area for two-wheeler and commercial spaces. Whenever people walk they use Itumbahal street as a shortcut.

Even two people cannot walk properly in Chokchya Galli where walking is unfriendly. Official vehicles enter the Durbar Square area which creates problems for pedestrian movement. During the daytime, more pedestrian movement can be observed in Indrachowk- Ason street. During morning and evening time motorized vehicles carrying goods, vegetables, fruits, etc. and rickshaw, the lorry is seen in most of the streets of this area which creates a problem for pedestrian movement.

People come to buy in bulk for shopping purposes in Ason-Indrachowk street. Tourists and other daily use people are seen moving around Hanumandhoka whereas Phyaphal is a commercial hub.

As this area is a historic settlement, road widening is not possible. Inch part of the land is in lakh price, say expensive. Most of the buildings on both sides of Ason-Indrachowk street are completely commercial and used as a warehouse for storing goods where the ground floor is used as shops and the remaining upper floor is rented. Native people of this area rarely reside here. Buildings along the street of Itumbahal- Kilagal are residential but used for rental purposes. As the road is not widened and narrow street huge traffic is created in these streets.

The building density of this area is high horizontally and building height is high vertically. The shopkeeper keeps their goods encroaching the street along the Indrachowk-Ason route.

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Quality of life is degrading due to the high rise in pedestrian density. There is no footpath in almost all streets, as well as the street vendors selling goods in the same street and also the shops in this area, are pedestrian targeted which creates huge pedestrian traffic in these streets.

Respondent Name : Mrs. Shova Maharjan

Position : Architect

Institution : Department of Archaeology

According to Mrs. Shova Maharjan, public vehicles are restricted and only private vehicles are allowed in this protected monument zone. There are separate building bye-laws and the Ancient monument preservation Act, 1956 for the buildings nearby this zone.

In her words, street vendors, private vehicles, and other motorized transport cause problems for pedestrian movement.

The architectural beauty of this monument area attracts people for time spent purpose which creates pedestrian traffic. Conferences, concerts, political activities also happen nearby Durbar Square which increases pedestrian traffic.

We see the Taj Mahal as an individual monument but in the case of this monument area, residences, shops, jattras happen frequently which makes a lively environment which is its unique features. People start worshipping temples from early morning which makes this place live.

She adds there is a more positive impact on pedestrians rather than a negative impact. The negative impact is environmental mismanagement. The conservation and construction of building in this monument area should follow building Byelaws 2064 and also should be permitted by the Department of Archaeology.

Particular space should be specified and time should be regularized for street vendors. Private vehicles entry should be prohibited in these streets. The private buildings should be preserved by following building bye-laws and the Department of Archaeology